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CAPE COD AND THE OLD COLONY*

By ALBERT PERRY BRIGHAM
Colgate University

In this essay are offered the results of a regional study of Cape Cod and of the western shore belt of Cape Cod Bay. The region includes Barnstable County, which is practically coextensive with Cape Cod, and the eastern, or coastal, part of Plymouth County. It thus embraces the entire land circuit of the bay. On the east is the open ocean from Provincetown to Monomoy; on the south are Nantucket and Vineyard Sounds; and Buzzards Bay lies on the west from Woods Hole to Buzzards Bay village and Onset.

CAPE COD A NATURAL REGION

We have here essentially a natural region. All but the northern part of the Plymouth County shore belt is of glacial or postglacial origin and has characteristic surface, soil, and vegetation. The shore line, developed on frail Pleistocene materials, matures rapidly and shows a variety of changing features. The climate is distinctly oceanic, and the Cape marks, as nearly as can be designated, the place where the Gulf Stream influences meet the chilling effects of the most southern reach of the Arctic Current.

Viewed in its human relations, the region is as much historically as physically unified. These lands were all settled by the *Mayflower* people or by their early successors in colonial endeavor. They all belong therefore to the Plymouth, or Old, Colony, the two being identical. The region under review does not, however, take in all of the Old Colony, which extended westward beyond the scope of this investigation and on the southwest included the sites of New Bedford and Fall River and some of the lands of eastern Rhode Island.

The industrial oneness of the bay area is in like manner pronounced. It has always possessed a meager agriculture, although the tillage and the

* This paper, read before the Association of American Geographers at St. Louis, Jan. 1, 1920, is based on more extended studies which have recently appeared under the same title in book form through G. P. Putnam's Sons, New York.

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products have been of a higher order than is commonly supposed. The environmental influences and the resulting activities of the people have ever been prevailingly of the marine order but in greatly variant forms, especially as seen in the summer industry which has grown up during the past forty years.

The Physical Geography of the Region

The unfolding and present status of the human geography form the primary aim of this paper, which might be called an essay in historical geography. The physical basis of Old Colony life will therefore be described in a brief and summary way as affording the foundation and guiding influence of the human activities.[1]

Its Glacial Formation

That glaciers and accompanying agencies have been the main formative forces has been recognized from the earliest observations which came within the field of scientific geology. These were made by Dr. Edward Hitchcock, who, indeed, did not voice such conclusions in the body of his Massachusetts report, but, impelled by the then new studies of Agassiz and Lyell, included in his preface a remarkable diagnosis of Cape Cod as the terminal moraine of a glacier occupying Cape Cod Bay. In more recent years, contributions to the geology and physiography of the Cape have been made by N. S. Shaler, W. M. Davis, and also by J. B. Woodworth, who after many years of investigation has now completed an extended report upon the entire region, including the outer islands, which fall outside the present study.

If we except the postglacial developments of alluvial, lacustrine, eolian, and shore formations, the youngest and most widely diffused deposits are of Wisconsin age. Prior to these, Woodworth distinguishes the following, from younger to older: (1) Vineyard interglacial interval; (2) Manhasset group, represented by pebbly till at Nauset Head and Jacob sands above blue clay at Highland Light; (3) Gardiner clay, at Highland Light ("clay pounds") and a few other localities; (4) Jameco gravel, under the Gardiner clay at Highland Light, old and consolidated; (5) Sankaty fossiliferous moraine sands in deep well near Provincetown and reported in well at Orleans. All of these deposits are considered to be of Pleistocene age, and no boring, well, or shore erosion around the bay has reached bed rocks belonging to older New England terranes. The characteristic thick accumulations and strong topography of the Wisconsin period are found in the Plymouth region, on all of the upper Cape, and even as far down as the town of Orleans and the southern part of Eastham. Beyond that point an older glacial topography appears as far as High Head in Truro. It consists of the

[1] In the paragraphs relating to the physical history, the author acknowledges his indebtedness to Professor J. B. Woodworth of Harvard University.

low plains of Eastham and of the higher and dissected plains of Wellfleet and Truro, all of which are in places masked by Wisconsin deposits which, however, rarely conceal the pre-Wisconsin expression of form.

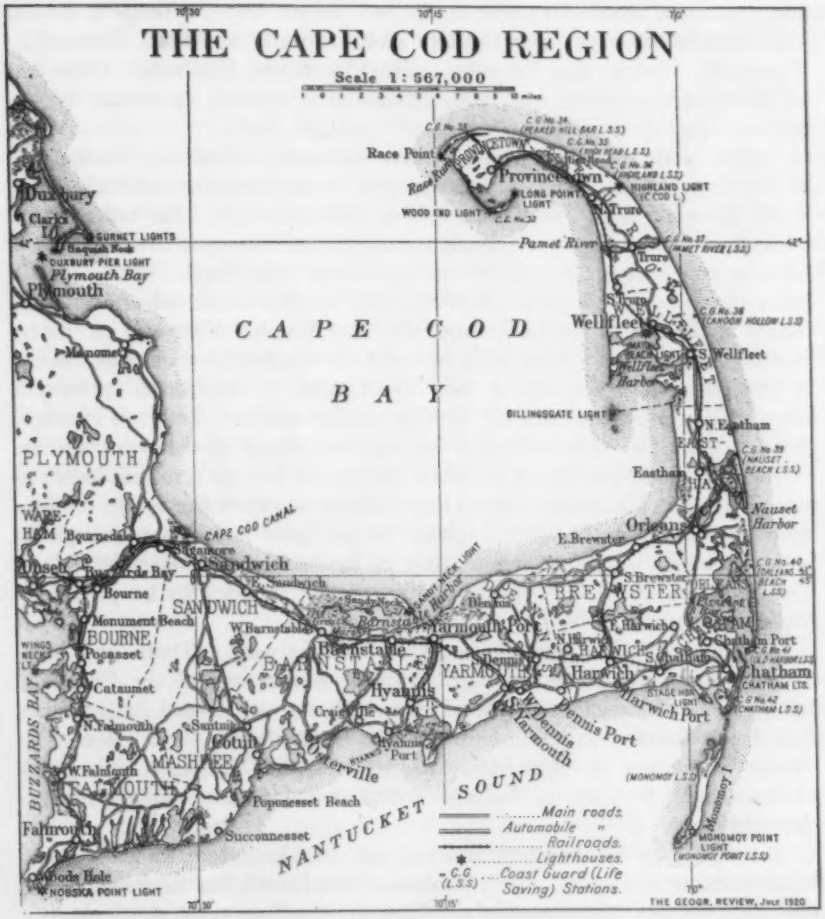

FIG. 1—Sketch map of the Cape Cod region. Scale, 1:567,000.

The Cape is often considered as the most northern extension of the Atlantic Coastal Plain; but, as Fenneman has pointed out, if it consists wholly of glacial deposits built above sea level on a submarine platform, it is not a true coastal plain. Such a glacial peninsula standing out into the ocean sixty to seventy miles from base to tip is, so far as the present writer knows, unique among the shore features of the continents.

The Glacial Topography and Its Origin

Looking more in detail at the glacial topography of the bay circuit, we find a belt of strong, morainic hills extending past Plymouth to Buzzards Bay, Falmouth, and Woods Hole. Branching at the village of Buzzards Bay, or in the town of Bourne at the base of the Cape, a range of glacial hills extends eastward, near the bay shore, through Sandwich, Barnstable, Yarmouth, Dennis, and Brewster, into Orleans and Eastham. These are all Wisconsin moraines, and deposits of similar age are, as already noted, found in patchy distribution northward to High Head.

South of the moraine, which is often unhappily called the "backbone" of the Cape as if there were a rocky axis, is an extensive outwash plain, which descends gently to the borders of Nantucket and Vineyard Sounds. This plain contains many kettle-holes, lakes, and swamps, the last-named forming the basis of the cranberry culture of the Cape. These kettle-holes were due to the presence of stagnant ice left as buried and isolated blocks in the retreat from the Nantucket and Marthas Vineyard ice fronts. Reaching from one to three miles inland from the southern shore is a series of parallel bays, which occupy outwash channels in the frontal apron and are due to submergence and invasion by marine waters. They are identical in origin with the bays indenting the southern shores of the outer islands.

We may therefore picture the Cape Cod glacial lobe as resulting from the recession of the Nantucket lobe to the northern border of the upper, or east-by-west, section of the Cape. There the ice front stood long enough to build a massive moraine, culminating in Bourne Hill at nearly 300 feet. The sands and clays were spread out in front of it, later to be pitted by the disappearance of blocks of the older ice.

At the same time, another ice lobe lay westward. There had been a retreat from the Marthas Vineyard front to the zone of the Elizabeth Islands. The ice deployed west of Plymouth and southward in Buzzards Bay, being therefore properly known as the Buzzards Bay lobe. Hence the Plymouth moraine is interlobate. It culminates in Manomet Hill, at an altitude of 394 feet, one of the most conspicuous landmarks on the Massachusetts coast.

If we go to the eastern shore and look out over the waters, we find reasons for a startling conclusion which Professor Woodworth has drawn from his prolonged studies. Southeast of the Cape are the Nantucket shoals, known for centuries as a menace to navigation. From 100 to 140 miles farther east are St. George's shoals, where tradition has a tale of a ship's crew playing baseball at low tide.

We may now recall what we know of the Maine coast, of the powerful glaciers that moved over it; of their great thickness, dominating and subduing even Mount Desert. We do not know how far a great glacial sheet invaded what is now the Gulf of Maine. To these considerations we add now a striking feature of the topography of the lower Cape in Wellfleet and Truro, namely, a series of about a dozen east-by-west channels which cross

it with floors descending to the west. One of the most conspicuous of these is the valley of the Pamet River, so called, which is only a tidal channel extending from the bay to the Atlantic side of the Cape. These valleys were described a hundred years ago by a member of the Humane Society in indicating the positions of rescue huts which might be sought by wrecked mariners. The valleys have every appearance of having been beheaded by the western migration of the shore cliffs.

The valleys must have been made by land streams flowing westward across the lower Cape. Whence came these streams? Let us follow Woodworth in putting the facts together. There was a great lobe moving over Maine to an unknown distance on what is now sea bottom. The St. George's and Nantucket shoals in character and alignment might be the terminal moraine. Waters spilling from the westward margin of the lobe could make the channels that cross the lower Cape. The evidence of the South Channel lobe may not be demonstrative, but it is strong.

We understand therefore that there were three lobes, the smallest, or Buzzards Bay, lobe on the west; the Cape Cod lobe, intermediate in position and size; and the great South Channel lobe. Furthermore, the Buzzards Bay lobe seems to have melted first, and the main drainage of the Cape Cod lobe swept across its moraine and opened the great passage at the base of the Cape which is now followed by the Cape Cod Canal. Then the Cape Cod lobe went out, or waned sufficiently for the drainage of the South Channel lobe to spill across the lower Cape into Cape Cod Bay. Such in brief outline is the origin of the deposits and land forms on and about the Cape.

Shore Line Development

The moraines with their irregularities and the outwash plains with their drainage creases were subjected to a submergence which left the shore line sinuous and broken. The waters intruded among the hills and entered seaward ends of the drainage channels. Such were the conditions when the land took its present stand with relation to sea level. The materials of the Cape and Plymouth shores are frail and easily shifted, and therefore the maturing of the shore lines has proceeded rapidly.

The most violent attack was on the eastern, or outer, coast, where the open Atlantic has been unhindered in its operations. The glacial headlands and promontories were cut away by powerful wave action, and the barriers and spits were brought to their present development. Professor Davis has dealt with the recession of the eastern shore line and with the disposition of the materials thus derived. It is to be remembered—and a glance at the topographic map brings the fact out vividly—that the older, or glacial, part of the Cape ends northward in the town of Truro at High Head, or Pilgrim Heights. Northward and westward are ten square miles of surface redeemed from the sea in the postglacial interval and now occupied by beaches, lagoon swamps and waters, and fields of dunes.

The waste first removed from the outer shore, as shown by Davis, was carried northward and westward and built into a bar on the bordering curve of the harbor of Provincetown. By the common processes of wave and wind work this extension of the Cape became the inner range of dune hills, as related to the present lands in and behind Provincetown. Further recession of the eastern coast cliffs afforded material for a bar outside of the first, thus widening the dune peninsula. Between every two successive bars there was a lagoon, like Race Run of the present time, and, like Race Run, these lagoons filled rapidly, and thus successive accretions were made into continuous land. This process has continued until the dune lands are now three miles wide from Provincetown northward to the open ocean.

The recession of the cliffs of Eastham, Wellfleet, and Truro has perhaps been equal in amount to the outbuilding at the end of the Cape. Hence Professor Davis has well likened the recession of the more southerly line and the pushing out of the northerly shore to the swinging of the land border on a fulcrum, located at or near High Head. The process is not yet complete. A beacon warns the sailor from Peaked Hill Bar, now building outside the northern shore and marking further widening of the new end of the Cape.

The rate of recession of the outer cliffs has often aroused curious inquiry. The government has lost approximately half its lighthouse site at Highland Light during a hundred years or a little more. Professor Woodworth thinks the recession has amounted to a third of a mile in the white man's time, three or four hundred years. There are reasons why the recession may not continue uniformly. It may safely be said, in a general way, that the Cape in that section has been losing width for some thousands of years and that it would require some thousands more to destroy these outer towns.

From the human point of view the most significant result of these changes has been the carriage of the waste under the influence of wind and wave westward and southward from the great bars above described to form the magnificent hooked spit which incloses the harbor of Provincetown.

Not all the material removed from the outer Cape has gone northward. Professor Woodworth indeed thinks that more waste is at present moving southward. The long line of Nauset beaches and dunes springs from the mainland in Eastham, shuts in the shore waters and deep bays of Orleans and Chatham, and terminates at the end of Monomoy about nine miles south of Chatham. Thus the main glacial mass is being cut back, and giant spits and bars are growing north and south, bringing the outer Cape into Gulliver's category of the "winged beheadland."[2]

Similar work is under way on the bay shore, as shown by the cliffs of Wellfleet and Truro. From the western side of High Head near the Provincetown waterworks in Truro there springs a beach which carries the highway and the railway northward. This is a natural barrier save for a short distance near Provincetown, where man finished the work of nature many

[2] F. P. Gulliver: Shoreline Topography, *Proc. Amer. Acad of Arts and Sci.*, Vol. 34, 1899, pp. 151-258.

years ago. The old East Harbor then became a fresh-water lake, with swamps under High Head on both sides. Thus an observer standing on High Head may in imagination see himself flanked by the bars and outgrowing spits, lengthening by the waste brought northward on the ocean side and on the bay side.

Some of the bay materials have gone southward, tying to the mainland in recent decades certain islands which flanked Wellfleet harbor on the west, and the soundings show a broad, slightly submerged bar extending for several miles into the bay southwest from Billingsgate Light.

Among other transformations of the inner shore, two localities have special interest. One of these is Sandy Neck, a dune-capped barrier which nearly incloses Barnstable Bay and the thousands of acres of the Great Marshes.

The other locality is the Plymouth neighborhood. Here some of the waste derived in the cutting of the splendid cliffs of Manomet has been carried northward and made into the beach which incloses Plymouth harbor. Joined to the mainland in Duxbury, the Duxbury beach reaches six miles southward and ties to the mainland the glacial island of Gurnet, where are now the twin Gurnet Lights. In Pilgrim days there were two islands within this beach. One of these, Saquish, has been tied to Gurnet since the *Mayflower* passed into the harbor. The other is Clark's Island, where the scouting party from the *Mayflower* in Provincetown harbor made the first landing and spent the first Sunday on the Plymouth side of the bay. Thus these postglacial beaches shut in the combined shallow waters of Duxbury, Kingston, and Plymouth.

The changes of the southern shore and on Buzzards Bay have been of a minor character, as was appropriate to these more quiet waters. Bars have more or less completely shut off some of the bays, and there are interesting examples of barrier beaches, cuspate forelands, sea cliffs, and tied islands, which make the shores attractive to the summer population and afford interest to the occasional physiographer under whose eyes they may fall.

Wind Work

The main theater of wind activity is on the exposed foreland leading from the outside of High Head around the circuit of Provincetown. Here the dunes have long been observed because their changes threatened the existence of the town and the perpetuity of the harbor. Hence there is a record of about two hundred years of more or less intermittent town, state, and federal activity in restricting pasturage, in preserving the forest cover where present, in the planting of beach grass and pine trees, and in other forms of sand binding. The bibliography contains references to guide the reader who wishes to pursue this line of inquiry in connection with the geography of the Cape. Elsewhere the most conspicuous examples of eolian work are found throughout the reach of Sandy Neck and on the long succession of beaches extending approximately twenty miles from the Nauset Life Saving Station to the southern tip of Monomoy Island.

Though popular impression is to the contrary, there has been little wind work of geological significance in the interior of the Cape. Occasionally the light soils of the glacial terrane have been disturbed and much sand has been swept from beaches and cliff slopes to the top of the coastal escarpments. Popular opinion has been misled here by writers professing to know, who have thought that the entire Cape was an aggregate of sand dunes.

The lagoons, tidal flats, and salt marshes have been important in relation to mollusk and other fisheries and in the cutting of salt hay in older days. They still have potential value, in the aggregate of many square miles which may be reclaimed, as population density becomes great, and become agriculturally productive.

The Human Geography of the Region

When the Pilgrims arrived on Old Colony shores in 1620, the region was not so much a land of mystery as has been supposed. Within twenty years there had been visits and explorations by Gosnold, Pring, De Monts with Champlain, and Captain John Smith, and both the Cape and the first home of the colonists had each received several names, including those which they now bear. For far more than a single generation European fishermen had frequented American waters, and there may have been many unrecorded visits to the Cape and visions of its shores. The conditions were hard enough for the colonists without imagining them as landing in a wilderness wholly unknown.

More than is commonly understood, the Cape, like Plymouth, belongs to the early Pilgrim period. The month of sojourn, of exploration, of deliberation and endurance in Provincetown harbor in late November and early December links the point of the Cape forever with the major settlement on the western side of the bay. Within twenty years also an active diffusion of occupation had reached far out from the Plymouth center. This appears in the migration northward of such foremost *Mayflower* people as William Brewster, Miles Standish, and John Alden and the occupation of lands in the present Duxbury and Kingston, Duxbury gaining its name from the ancestral home of the Standishes in England.

There was a still more extended migration to the south and east, for the oldest town on Cape Cod, the town of Sandwich, was settled in 1637, while Barnstable, the county seat of Barnstable County, celebrated its two hundredth anniversary in 1839. Yarmouth was contemporary with Barnstable in its beginnings and was the parent town of Harwich, Chatham, Dennis, and Brewster. Even Eastham, far out on the Cape and at first known as Nauset, was settled as early as 1647, and there were those who, unmindful of the limitations of the district, were in favor of moving the whole Plymouth colony thither. Truro was settled about 1700, and Wellfleet became a separate town fifty years later. Provincetown was merely a precinct of Truro in 1714 and did not receive separate incorporation until 1727. Thus the colonial movement passed from Plymouth down the Cape and occupied

a century in arriving at the first resting-place of the Pilgrims. Then the circuit of the bay was complete, and the southern shore was also occupied by early settlements in Falmouth, Barnstable, and other towns.

Geographic Influences Affecting Early Settlements

It is not difficult to find the geographic reasons for the choice of sites for Old Colony centers of population. The colonists desired a good harbor, for they expected to live in relations with the outer world. This they found behind the Plymouth beach. They found also a strip of land which had long been cleared and cultivated by the aborigines. To have built their homes in the winter, in the face of sickness and death, and to have added to their burdens the clearing of a forest for the next season's planting would have been beyond human power. There were ample supplies of fresh water, and there was timber at hand for houses and for ships. Moreover, Plymouth was in a region almost empty of savages, owing to the sweep of a pestilence some years before; and for enemies that remained, who might rally for attack, there was an isolated hill affording the best facilities for fortification and defense. The soil, for eastern Massachusetts, was good, and there were wild fruits, herbs, and fibers.

Other Old Colony positions offered similar, if less abundant, attractions. Sandwich is in a niche among morainic hills and has a stream for small water power and for the ascent of the herring. Falmouth is on a fertile plain at the eastern base of the moraine, close by fresh lakes and inlets from the sea. Barnstable is on good soil, by the waters of an ample bay, and counted much on the large supplies of salt hay from the Great Marshes. Hyannis is at the head of a branch of the great Lewis Bay and necessarily on the southern-shore highway. Chatham was planted in the midst of a network of protected waters, and Orleans is at the head of Town Cove, a secluded bay which admits the tides to the middle of the Cape. Wellfleet stands at the head of its great harbor, once white with sails and affording upon its wide acreage of shallow bottoms a home for large crops of quahaugs and oysters. Truro is on the tidal inlet of Pamet River, once a good harbor, then destroyed by silting, and now being re-opened by the dredge. North Truro is the old Pond Village, by a small lake in a bowl-shaped hollow, where the dwellers are protected from the fierce winds of the outer Cape. Provincetown, late in origin, has outstripped other towns of the Cape for reasons that are purely oceanic—harborage, fishing, and the romance and scenic beauty of a marine environment.

Agriculture and Fishing the First Occupations

The greater part of the Old Colony was covered at least with isolated settlements by 1692, the year in which the Colony was merged with that of Massachusetts Bay. This is a convenient, if somewhat arbitrary, time marker to set off the period of beginnings. Agriculture was the staple

occupation of the colonists from the very outset. They came without even fishhooks or nets for the smaller fish, or apparatus for whales, which played around the *Mayflower* and tantalized the wayfarers with visions of unattainable wealth.

The soils in Plymouth and at other places were pronounced good, even to a spade's depth of true mold in some places. The corn found in Indian caches on the outer Cape was a forecast of the ample crops of this essential grain which would be raised for many years. Twenty, forty, and even fifty bushels per acre were not unusual crops, and the Cape, even the seemingly dreary and barren Nauset, had corn enough and to spare. It was the period of home industry in which all necessities must be met out of the home soil, save as trade should provide funds for getting furniture, clothing stuffs, and other necessities from the mother country. There were no roads or white men to the westward. The Old Colony was not then required to adjust itself to a developing continent that would later stretch out behind it to remote seas.

Though the Pilgrims did not come to fish or to sail, they were forced to do both by their marine environment. Though the Plymouth fathers "sucked the abundance of the seas," they were never very successful in fishing; but they knew the cod, the herring, and the eel, and they did not require large appliances for gathering the shellfish of the Plymouth flats when the tide was out. From the beginning and by geographic pressure more and more as the generations came and went, they became an "amphibious" people.

The Development of Whaling and the Fishing Industry in the Colonial Period

The seventeenth century led into larger growth, along similar lines, throughout the remainder of the colonial period to 1776, the year of independence. Agriculture of the old type was continued, house industries were universal, and small mills and factories were erected. The grist mill was imperative, and within a few years of the *Mayflower* mills were built at Plymouth and then, to save long and laborious journeys, at Sandwich. Surface streams with suitable fall are so rare on the Cape that wind power was invoked, and the windmill became a common object in the landscape, the few surviving towers being now regarded as among the most characteristic reminders of the older days.

Throughout the colonial period the securing of drift whales engaged the interest of all Old Colony men. To watch for drift whales was a distinct part of public duty in Plymouth, and various towns record regulations to secure private and town rights in such spoils. Readers of Thoreau will recall his diverting comments on the minister who watched the waves for this important addition to his meager salary.

In time boat whaling, for the taking of these creatures in offshore waters, became an important enterprise. An official letter to England in 1688

asserted the great profit of whale killing to the Plymouth colony. The Old Colony was the pioneer in this industry, even Nantucket having followed its leadership and sought its instruction. Down to 1700 Nantucket was the only place outside of the Old Colony that had whaling interests. As early as 1737, Provincetown was sending a dozen whalers to Davis Strait in the far north. At the opening of the Revolution, Wellfleet, Barnstable, and Falmouth had thirty-six whaling vessels, mostly in northern waters.

Whaling and other fishing had reached a large development at the end of the colonial era. The Old Colony then had more than a thousand ships and more than ten thousand men engaged in the work, though Marblehead and Gloucester had taken precedence of all Cape towns. Plymouth and Chatham were the Old Colony centers, Plymouth having sixty vessels and Chatham about half that number. Thus at a time when nearly all Old Colony men were trained sailors, they were ready to take, as they did take, a large part in driving the French power from North America. Equally important was their service in the American navy in the War of the Revolution.

The Fishing Industry in the First Half of the Nineteenth Century

This war, however, marked the well-nigh total disappearance of fishing, including whaling, from the New England shores. At the end of the war, the fishing vessels were few, but of widows and sonless mothers there were many in all Cape Cod towns. A picture of the industrial ruin the war brought to the Cape is drawn in the plea of Fisher Ames in 1789, explaining why, if fishing was so decayed and profitless, the men did not leave the region. He said, and it was no uncommon remark in those days, "they are too poor to live there and are too poor to remove."

There was a recovery in fishing after the Revolution, which, although checked in the War of 1812, assumed large proportions in the first fifty years and more of the nineteenth century. Along with fishing grew up in the same period that vast and world-wide extension of sea trade which is one of the glories of New England history.

If we take the first century of the federal period, we may say of Old Colony fishing and marine commerce that they reached their supreme development about 1850 and were far down in decline after the Civil War. By 1800 the Plymouth shore was lined with fishing structures, and the markets were as remote as Spain, Portugal, and the Atlantic islands. At about the same time Provincetown had no less than thirty vessels, carrying their voyages as far as Newfoundland and Labrador. Wellfleet trade was large, and even Duxbury was building ships and catching cod. There was half a century of codfishing in which most Old Colony towns had a part, yet today one may spend a week in any one of them with a good chance of neither seeing nor hearing mention of a codfish.

With the decline in codfish in the middle of the century, the mackerel was taking its place. Wellfleet began her mackerel trade in 1826 and had seventy-five schooners in the business as late as 1860. The facts were sim-

ilar as regards cod and mackerel in Dennis, Harwich, and Chatham. In the last place, however, nature intervened and by silting the harbor made it impracticable for cod-taking craft, while the smaller mackerel boats could still come and go.

The great decline in fishing in the twenty-five years following 1850 was due to a number of causes. Competition of Great Lakes and Pacific coast products was made possible by railroads and cold cars, and the sardines canned on the Maine coast slackened the demand for mackerel. The introduction of seines in place of lines and hooks put the young boys out of employment, and they began to abandon the Cape. There was enforced idleness in some parts of the year, and the toll of manly life taken in those dangerous seas was so terrible that young women hesitated to marry seamen. Thus the dangers of the business, its change in technique, and the pressure of outside competition reduced the industry to minor importance.

As a natural concomitant of Cape fishing there grew up a widespread salt industry. The Cape shores in the earlier years of the last century were lined with simple plants for the evaporation of sea water. This manufacture culminated soon after 1850. Then western and foreign salt began to contest the market; the lumber for vats, which was Maine pine, became more costly, and the business fell off. There were at one time several hundred plants with an annual output of a third of a million bushels. The last salt plant on the Cape, so far as is known to the writer, was operated in Yarmouth as late as 1885.

Whaling also was at its maximum in the first half of the last century, culminating just after 1840. Falmouth, Plymouth, and Provincetown were all important whaling centers. For most of the towns the last recorded sailings of whalers ranged from 1846 for Barnstable to 1867 for Wellfleet. Provincetown still had three whalers in 1906, and there are today six whalers assessed in Provincetown, but they fit out and land at New Bedford.

Coasting and Oversea Trade

The same period that saw the great expansion of fishing and whaling saw the growth of coasting and oversea trade by those swift sailing vessels that were owned in every port of the Old Colony. At the present time a single steamship plies between Boston and Provincetown, but only in summer time. Plymouth also has a summer boat from Boston. Otherwise the sea is abandoned for the train and the automobile. But conditions were very different from 1800 to the advent of the Old Colony Railroad. There were Cape residents who were at home in the Orient who had never gone to Boston by land. The packets were swift and had regular sailings from ports which today harbor only the minor craft of small fishing or pleasure sailing.

Ships owned in Brewster, Barnstable, Falmouth, indeed in almost all the Cape towns, made voyages to the West Indies, to South America, to the ports of the Indian Ocean, of eastern Asia, and of Australia. Thirty years ago

the villages of the Old Colony were full of retired sea captains, who lived in mansions which they or their seagoing ancestors had built. At the present time nearly all who took part in this marine life have passed away, and the mansions in Barnstable, Yarmouth, Brewster, and other villages are occupied by their descendants, either as permanent residents or as summer visitors, or have passed into other hands. The old era of Cape Cod is closed, the time when most of her men were trained to the hazardous life of the sea, were conversant with remote lands and cities, and gained the wide outlook derived from daily experience of the ocean.

The Decline of Agriculture and Fishing After the Civil War

This great decline in the activities of the Old Colony shores took place rapidly after the Civil War. The invention of the steam engine revolutionized seagoing ships. As they became larger and could only move in deeper waters most of the harbors, being shallow, fell into disuse. The railroads brought Western commodities into competition with home products, and there was a great decline in agriculture. This was also due in part to the exhaustion of Cape soils. There are no extensive grasslands on the Cape, and the production of grains is small, thus preventing the keeping of much live stock and limiting the amount of fertilizer which might have served to perpetuate the fertility of the fields. Such exposed towns as Truro and Eastham show at the present time few and small areas of cultivated land as compared with early days.

Fishing has concentrated mainly in the larger centers of Boston and Gloucester, and the mollusk fisheries have in like manner suffered a long decline. Provincetown in Thoreau's day was filled with drying codfish, and scores of ships served the oyster trade of Wellfleet. Proper conservation has not been applied to the preservation and development of the edible mollusks. The fathers thought them inexhaustible and treated them recklessly. The later decades have seen heavy demand and larger production, but this at the expense of almost exterminating these forms of life in some localities. The increasing paucity is shown by the fact that quahaugs are now tonged off some Cape shores at depths of fifty and sixty feet. The fishing sheds and sail makers and boat repairers are few in all Old Colony villages, and the ancient docks are falling to decay.

Decline in Population

With the breaking up of marine business the main motive for living on this foreland has been impaired, and many of the more progressive and ambitious people have migrated to Western homes and larger opportunities. There has been a decline in the population of many Cape towns and of the Cape as a whole. The town of Truro is a typical example, having lost its marine life and not having gained as yet such compensations from summer trade as have come to a number of the other Old Colony communities. In

1800 Truro had about 1,150 persons. It moved steadily with the general marine growth and had in 1850 a population of 2,100. Then began a steady and unbroken decline until 1910, whose census record showed a population of less than 700. Provincetown, on the other hand, having 200 persons at the opening of the American Revolution, did not cease to grow until 1890, when the population was about 4,600. Then there was decline until 1900 and some recovery to 1910.

The whole of Barnstable County had 12,000 inhabitants in 1765 and grew in numbers in every decade until 1860, when it had 36,000; after that date it fell more or less rapidly until 1910, when the total was between 27,000 and 28,000.

Modern Adjustment to the Life of the Summer Resident

It remains to observe the changes that have come in the life of the Old Colony region during the last half century, or since 1870. The fundamental condition, as in all the earlier history, has been the marine environment, but the reaction to it has been in the main of a new order. A dense and wealthy population has occupied the New England interior, the Middle Atlantic States, and the Mississippi Valley. The common needs of the coastal region are now met not by home industry but by purchase. A hotel in Chatham or Wellfleet may order even its fish and its lobsters from Boston. Cape Cod no longer derives the major part of its income directly from the sea.

The region belongs, however, to the ocean as much as ever it did. It does not draw out its living with hook and seine or get valuable booty with a harpoon; but it has resources in wave and surf, in cool and salty winds, in cliff, dune, field, and moor, in lake and forest, in expansive views, in historic lore and patriotic ideals. It is the home of the fathers, a land of the imagination, a place for rebuilding shattered energies. These resources have become tangible; they are transformed into money; and, reluctant as the elder men may be to admit the change, the leading industry of the Cape is not fishing nor cranberry growing but the summer resident. The Old Colony in its three centuries of geographic unfolding has reached its place of adjustment in reference to the continent behind it. To fish, to catch whales, to raise corn—these were temporary conditions, leading up to uses to which the land is most suited and in which it may fill its largest place in the greater domain of which it is a fragment.

Localization and Specialization of Industries

This change does not mean that the old occupations are dead. There will always be fishing and sailing, farms and crops; but these will be limited, localized, and special. There are, in place of stacks of drying fish, several refrigerator plants in Provincetown, and there is one each in Truro, Yarmouth Port, Barnstable, and Chatham. There are fish weirs at Province-

town and Truro and off the southern shores of the bay; there are lobster traps; and the oyster, the clam, the quahaug, and the scallop are still harvested. These industries, however, are only fringes on the edge of a larger life. There are more automobiles than there are bushels of oysters in a Wellfleet season, and there are more artists than there are codfish in Provincetown. One can chaffer with a stray fisherman off the dock at Plymouth, but Plymouth is mainly at home in her Pilgrim memories and in her great factories. We may not agree in interpretation of the facts, but we recognize the great change expressed in the utterance of the now elderly daughter of an old sea king of Truro, "The Cape ain't what it used to be, its runnin' down fast."

The writer has seen cornfields on the upper Cape which would look well in Illinois or in Iowa, but corn is no longer a staple crop in that region. Around Barnstable and in some other towns are good meadows and pastures, replacing the salt hay that was formerly much esteemed. Today, however, the piles in the marshes are going to decay, without supporting the picturesque stacks of the old time. Yet "English" hay will never be extensively grown on the light Cape soils.

There is a notable revival of agriculture, but it takes special forms adapted to soils, climate, and the markets. The main specialties are apples and small fruits, vegetables and poultry. Dairying is and must be small and local because this industry cannot carry the heavy cost of Western feed and the pastures are inadequate. Apples thrive under modern care, and there are model orchards of fine fruit even as far down as Truro, where protected situations are utilized and scientific care is given.

The Cranberry Industry

The great development in small fruit is in the cranberry, in which Barnstable and Plymouth Counties lead all other parts of the United States. The culture was developed on the Cape less than a hundred years ago, and all Massachusetts cranberries are often named as of Cape Cod, though Plymouth County produces more than the Cape. Like most other crops, the cranberry has seen much modern improvement in care and in harvesting, and plantations are larger or consist of many fields under one management. A single company operating in Plymouth County controls about 800 acres of bogs.

All the natural conditions needed by this fruit are perfectly supplied in this region. The natural marshes, due to glacial blockade and the filling of shallow lakes, afford the chief requisite. The water needed for flooding is at hand, by gravity flow or by pumping, and there are ample and convenient beds of sand for sanding the bogs. In addition, the growing season is long, and the severe frosts of autumn are usually subsequent to the period of harvest. The cranberry is a nearly perfect adjustment to nature in the lands of the Old Colony.

Other Fruits and Vegetables

The fruit next in importance, but a remote second, is the strawberry whose development was much later here than the culture of the cranberry The main center is the town of Falmouth, and the cultivators are the somewhat recent Portuguese immigrants. These newcomers have bought old farms and have cleared many fields in the oak scrub north of the main highway, where strawberries are supplemented by red raspberries and several kinds of vegetables, with some corn and beans. The markets for the berries are found locally and in Boston, seventy-three carloads of strawberries having been shipped from the Falmouth village station during the season of 1919.

One vegetable, asparagus, is assuming commercial importance as a characteristic Cape product. The principal development is in the town of Eastham, where some large and many small fields are found, and it is extending into other parts of the Cape. There is no reason why asparagus and strawberries should not be grown in nearly all parts of Barnstable County. The cranberry does not move eastward much beyond Orleans on the outer arm of the Cape.

Several nurseries have been established, including one forest nursery of the state of Massachusetts. Work was begun on this nursery in the outskirts of Barnstable village as late as 1913, and already the nursery has 4,000,000 trees in various stages of growth, including 2,000,000 white pines which will be ready to transplant in 1920. There is much reason in climate and soil for future progress here in the nursery industry.

Large-Scale Farming

Some attempts have been made at farming on a large scale, with modern machinery and the use of all advanced methods. It has been shown that there are areas of productive soil, and good results have been gained. It has not been shown that such farms could ever meet the large overhead charges which could be afforded by men of wealth. Thus there is a ranch of 14,000 acres near Hatchville, the lands being part of the outwash plain in Falmouth and Sandwich. Tractors are used for clearing, modern buildings have been erected, blooded herds established, large fields of corn and other forage crops put in, and an asparagus plantation started.

In like manner the smaller Lombard ranch at Forestdale, in Sandwich, demonstrated the existence of eighteen inches of good soil. Luxuriant crops were raised where but two years before there was oak scrub. Such work requires free use of capital. Small undertakings demand the owners' hard labor and are therefore confined to Portuguese and Finns who, with their large families, are accustomed to toil and win success in fields which the native Americans do not attempt.

Manufacturing

The environment of Cape Cod Bay has never given itself largely to manufactures. Water powers are few and small, and such industry therefore lacked the early impetus which it received in many other parts of New England. Grist mills and small woolen mills met the needs of the local people, but in the main these have disappeared. Salt was made, as we have seen, on a scale large for the times; but that industry, too, has completely passed away. At one time the largest glass factory in America was operated at Sandwich, but that was long ago abandoned, and the buildings are beginning to fall into ruin.

Such important manufacturing centers as Brockton, Fall River, and New Bedford had grown up in the Old Colony, but these lie outside the field of this essay. The two exceptions to the general rule in the bay county are Plymouth and Sagamore. At Plymouth are immense cordage works, which bring their raw material from Yucatan in their own ships and land it on Plymouth docks. The town also has large textile and metal works; but they have not seriously invaded the historic center of Plymouth, and they do not injure the Pilgrim atmosphere or make the town any the less an alluring place of pilgrimage.

Sagamore, in the town of Bourne, long a part of Sandwich, the oldest Cape town, offers a discouraging introduction at the gateway to those who visit the Cape expecting only rural simplicity and the solitudes of the sea. The great car shops do not seem in keeping with the marine border. But they are soon left behind with the barren wastes of the canal dumping, and the forests, marshes, sand dunes, and water vistas of the real Cape Cod begin. We may say of the factory, as of fishing and farming in the Old Colony, that it has become specialized and localized. None of the three longer stands for the main motive or leading occupation of the Cape or its Plymouth background.

Railroads and Highways

As in every modernized region, the processes of invention, applied to transportation, have gone far to revolutionize the geography. The railways approaching Plymouth from the north and west find their terminus there. These roads run from Boston by way of Hingham and Duxbury, from Boston by way of Whitman, and from Middleboro, which is the Old Colony outlet to New York City and the South. Curiously, no steam or electric road leads along the shore to the Cape, over the first long trail which the Pilgrims most used. There is, however, a state road through the coastal forests from Plymouth to Sagamore and Buzzards Bay.

The main highways of the older Cape were, as we have seen, on the water. Steam enlarged the ships, drove out the packets, and brought in the railway, which made water transportation unnecessary for reaching inland places or the northern shore. At the same time the advent of the

Old Colony Railroad removed the stages from the heavy sand roads of the Cape. The railway was opened from Middleboro to Sandwich in 1848, to Hyannis in 1854, to Wellfleet in 1869, and to Provincetown in 1873. The Chatham branch was finished in 1887. Woods Hole had been joined to Buzzards Bay and the main line in 1872, the year in which the various branches became known as the Old Colony Railroad. The conductor who ran the first railway train into Provincetown still lives in Orleans.

The state roads, which are now perhaps the most marked feature of the whole region, save the bordering sea, followed upon the invention of the automobile. There is a trunk line near the northern shore and another near the southern shore of the upper Cape. These lie far enough back from the main water to pass around the heads of the numerous bays and salt marshes. Some parts of these lines are almost a continuous village, as from Barnstable to Brewster and from Hyannis to Chatham.

Connecting roads have been built through the forests from one main line to the other across the Cape. One joins Woods Hole and Buzzards Bay along the Buzzards Bay shore; another leads northward from Chatham and, uniting with the north shore line at Orleans, becomes the trunk road of the outer Cape, ending at the Pilgrim landing place in Provincetown. Spurs of improved road lead out to the open sea in Orleans, from North Truro to Highland Light, and in Provincetown.

The Cape is not now so much engaged in sailing ships as in helping other people to sail them. Marine maps show hundreds of wrecks off these fateful shores. The Humane Society's huts were in due time succeeded by a chain of fully equipped life-saving stations, stretching from Race Point to the southern end of Monomoy. Cape Cod light, commonly known as Highland Light, is the most powerful on the New England coast and is supported by other beacons and light ships at danger points of the inner and outer shores.

The Cape Cod Canal

We may now recall the remarkable scourway opened at the base of the Cape by the waters from the glacier of Cape Cod Bay. Tidal waters entered it from the north and south, and from either side the lofty hills of the moraine look at each other across the gap. Plymouth colony was barely two years old when Governor Bradford visited Manomet River and saw the facility with which trade could be carried on between the two great bays. Like all great canals, as Suez or Panama, possibilities were seen long before they were realized, thousands of years for Suez, hundreds for Panama, and generations for Cape Cod. Washington was interested in the Cape Cod project, and a survey was made by a Cambridge engineer in 1791.

Not until recent years was the canal completed, but it has already become one of the important waterways of the Atlantic coast and a part of that great system of protected channels by which communication will, in the near future, be established between our Northern and Southern shores. Already the New York and Boston boats use the inside route, and the tows of coal

barges are less often seen from the eastern cliffs, pursuing the old and dangerous route of the stormy Atlantic and the treacherous Nantucket shoals. The saving of distance is from 63 to 152 miles for ships moving from any ports between New York and Providence to ports north of the Cape. The New York and Boston boats shorten their running time from sixteen or eighteen hours to thirteen and one-half hours. Government ownership and release from tolls would invite all, or nearly all, shipping along the coast to the safe inside route.

Evidences of Prosperity Due to the Summer Life

The summer industry has become the dominant interest of the Cape. This may not be capable of proof in figures, but of its truth the author, after some years of observation, has no doubt. Indeed, only one resident of the Cape—and inquiry has been made of many—has expressed a contrary opinion. In this instance there was, it would seem, reluctance on the part of an old and honored citizen to concede that the old life of the Cape has been so largely replaced by a new order.

There is not much winter activity, but the summer life expands in every town; in a few, whether one likes it or not, there are displays of an almost metropolitan activity. The financial returns of this industry come in by numerous and often untraceable channels. The hotels and boarding houses, the provision stores and garages could count their annual receipts and profits. We are, however, to take account of the stated and year-round outlays upon summer homes, the vast increase in taxation values, the outlay for roads, and many other things in which the Cape exchanges the boon of nature for the support of its life.

The new growth may be marked in the increase of summer train service and more recently in the vast movements on the state roads. A single day's census in the village of Hyannis during the summer of 1919 showed that 9,000 automobiles within the day passed a given point on the main street of the town.

The town of Falmouth in 1872 had taxation values of less than $2,000,000. The next quarter century almost quadrupled the valuation of the town, and another twenty-five years brought the figure to $20,000,000. This sum does not now appear on the tax roll owing to recent changes in the order of state and federal taxes. There is no possible source for most of this increase, other than the expansion of the summer life. Chatham about quadrupled its valuation from 1890 to 1919, and the facts are similar for some other towns. There is no apparent limit to the enlargement of summer business which may take place in the future.

Changes in the Character of the Population

The circuit of the bay has in three hundred years seen interesting changes of population. The changes in totals have already been noticed. It remains to refer to modifications of the primitive stock. The whole region is

sparsely peopled, because the soil resources are small, because it is not suited to the growth of cities, and by reason of the migration westward of the sons of the Old Colony. Barnstable County's density at the census of 1910 was 67.8 to the square mile as against 418.8 for the entire state. Plymouth County had a density of 213.8. If, however, we leave out the city of Brockton and other industrial centers of the interior, we should find that the shore areas are much like the Cape.

Barnstable County had in 1910 a little over 13 per cent of foreign-born inhabitants, a figure so low as to be in striking contrast with Boston or any other large city of the state. Plymouth County had only about 20 per cent of foreign born, although it contains the large manufacturing city of Brockton. The foreign born consist more of Portuguese than of any other nationality. They have come from the Atlantic islands and from Portugal and represent both white and black Portuguese. The older incursion of this nationality is in Provincetown, where the Portuguese probably constitute nearly half of the permanent residents. They have spread southward into Truro. The recent Portuguese incoming has been in Falmouth, where they number perhaps 1,000, and they have spread eastward through Barnstable as far as Harwich and Chatham. They are fishermen to a considerable extent on the lower Cape but are given to the soil on the upper Cape.

The Finns have long formed a small colony in Barnstable, and the Italians center in Sagamore and Sandwich, many of them being employed in the Keith Car Works. There are some recent comers from England and other parts of Great Britain, which fact if taken into account would reduce the percentage of the foreign born who are in any sense alien to the primitive colonial stock. Altogether we may say, and it is one of the alluring features of these shores, that here we still have one of the most American parts of America.

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THE SAN BLAS INDIANS OF PANAMA

By S. P. VERNER

The San Blas Indians of Panama are well known by popular repute. Every visitor to the Canal Zone hears of their peculiarities, yet scientific knowledge of this tribe, so interesting in itself and in the circumstances of its survival, is exceedingly limited. The present "San Blas country" lies in the province of Colon, east of the city of Colon, and includes the islands off the Caribbean coast between Colon and Colombia, beginning about 40 miles east of the Canal and extending for about 70 miles towards the Colombian border. Occupying a territory in which the white settlement is the oldest in America, these Indians have nevertheless resisted subjugation for four hundred years and, except for a few minor modifications produced by their occasional contact with civilization, are practically what they were when Columbus first saw them.

Small Stature

The most striking physical characteristic of these Indians is their smallness of stature, with their very marked Mongolian features as a close second. They probably do not average five feet in height, while full-grown men several inches shorter are quite common. Their bodies are long in proportion to their legs; their chests are usually finely developed. They are splendid tree climbers and expert swimmers, while their skill with the canoe is marvelous. They will successfully negotiate the voyage from their islands to Colon in fifteen-foot dugout canoes in waters as bad as any in America, where the white men hesitate to go in launches or larger craft.

Mode of Life

The San Blas islanders live in palm-thatched houses of sticks and palm-fronds, some of the islands being practically covered with their dwellings,[1] placed so close together as to look like one immense building covering an acre or more of ground. It is probable that the Indians deserted the mainland for residential purposes to escape the mosquitoes which infest the marshes along shore but which are notably absent from the cays. They live mainly by hunting, fishing, and petty agriculture. The principal crops are corn, plantains, cassava, and rice, while they possess fine plantations of coconut palms and ivory-nut palms, which form their chief sources of wealth.[2] They go to the mainland daily to cultivate their farms, to get

[1] Frederick Collins: The Isthmus of Darien and the Valley of the Atrato Considered with Reference to the Practicability of an Interoceanic Ship-Canal, *Journ. Amer. Geogr. Soc.*, Vol. 5, 1874, pp. 138–165; ref. on p. 141.

[2] Henri Pittier: Little Known Parts of Panama, *Natl. Geogr. Mag.*, Vol. 23, 1912, pp. 627–652; ref. on pp. 650–651.

wood and water, to hunt, and, it has been stoutly maintained for years, to work their secret gold mines. The San Blas either have inherited considerable gold from their ancestors or they have a way of obtaining the precious metal still, for the women wear gold ornaments and many of the men own quantities of gold which they will not part with.

Aloofness

There are many local legends concerning the inhospitable attitude of these Indians towards whites attempting to penetrate the interior back of their islands. It is said that they have an iron-clad rule that no stranger shall remain in their territory after sundown, and authentic cases where they turned back would-be explorers have occurred frequently enough to justify the statement, while some white men who tried the trip were never heard from again. It is true that less is known of the mountainous region between the head of the Chagres River and the Colombian frontier, on the Atlantic side, than of any other part of Panama. During the reconnaissance surveys for a ship canal in the early seventies, Selfridge's party penetrated the interior back of the Gulf of San Blas but met with no opposition from the Indians.[3] Dr. Henri Pittier, the noted botanist, likewise got into part of the interior, with a San Blas boy as a cicerone, and was inclined to scout the theory of inadmissibility.[4] However, he was an exceptional explorer of long experience and fine diplomatic power. This exclusion of strangers by the San Blas is due to a primitive distrust of the alien, coupled with a recollection of their wrongs at the hands of the Spaniards, as well as to their independence and their pride in the purity of their race.

Clothing and Housing

The San Blas are beginning, however, to show many modifications in their aboriginal customs produced by contact with the whites. This is seen chiefly in their dress, which now often consists of cotton cloth of English manufacture, while the men, especially when visiting Colon or Panama, go clad in complete suits of clothes. The women still wear the short skirt and colored chemise, appliquéd in curious designs, which was their costume two hundred years ago.[5] Most of the women wear gold nose-rings, and they adorn themselves with many necklaces of beads and metal coins. Their needlework is exceedingly skillful, and they make a kind of tapestry. They are also fond of making figured cloth out of cotton fabrics bought from the traders; and they buy different colored cloths, dyeing them with their own pigments. They design ornamental pieces very skillfully, much of their work having been shipped to Germany before the war.

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[3] Collins, *op. cit.*, p. 140. See also footnote 12, below.

[4] Pittier, *op. cit.*, pp. 646–647.

[5] Eleanor Yorke Bell: The Republic of Panama and Its People, with Special Reference to the Indians, *Ann Rept. Smithsonian Institution*, 1909, pp. 607–637; reference on p. 630.

FIG. 1.

FIG. 2.

FIG. 1. A San Blas Indian (second from the right). The shortness of stature is evident from a comparison with the West Indian negroes and the American in the group.

FIG. 2. A group of San Blas Indians. (All photos by Dr. George Curney, the official physician of the Panama Government in charge of the first dispensary and hospital in the San Blas country.)

The houses of the San Blas are large and skillfully constructed with a thatched gable roof, supported by columns of bamboo or palm-tree posts. The interior is divided into compartments by upright posts.[5] They have recently begun to build houses of planks, and some of the wealthier Indians are ambitious in this respect.

Number

Estimates differ as to the numbers of the San Blas Indians. As high a figure as 50,000 is given by J. Dyneley Prince.[7] Others place it at 8000 to 10,000.[8] Certain it is that today they are increasing rapidly. Their growth is particularly interesting in view of the decimation that had gone on between the time of their discovery and the treaty with Spain, by which the Spaniards abandoned all their forts in San Blas territory.

Relation to Present Government

The San Blas are shrewd, energetic, and healthy, and will soon become well civilized under the new régime in Panama if a benevolent policy is consistently and intelligently pursued. They are loosely organized under a chieftain, with several sub-chiefs, and there have recently appeared a number of rival aspirants for recognition as their representatives before the Panama government since the latter has attempted to incorporate them into its organized citizenship. Most of them steadfastly refused to acknowledge the sovereignty of Panama after the secession in 1903 and persisted in regarding themselves as Colombians. This fact was somewhat humorously ignored, and only in the last four years have diplomatic efforts been specially directed toward getting them into the Panama fold, a step inaugurated largely by President Porras and the American Minister, Mr. Price. Their indifference to the new régime which had started near their doors is illustrated by their refusal to allow the Canal authorities to get sand at one of the settlements, the chief of the village replying to the Canal Commission's request that if God had meant the Americans to have that sand, He would have put it at Colon. Miss Coop, an American missionary, went to live among them several years ago and has made considerable progress in elementary education with her pupils. In 1915 the Panama Government established a custom house on one of the islands of the San Blas, where all trading boats must clear.[9] The Republic now has a resident official in their capital, with a physician and a staff, and is beginning to promote the assimilation of the tribe.

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[6] Pittier, *op. cit.*, p. 657.

[7] J. Dyneley Prince: Prolegomena to the Study of the San Blas Language of Panamá, *Amer. Anthropologist*, Vol. 14, 1912, pp. 109-126; reference on p. 109.

[8] Bell, *op. cit.*, p. 626.

[9] J. G. Steese: San Blas Indians Leaving Their Isolation, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, p. 773.

Origin

It is difficult to get much light on the origin of the San Blas, since their culture is primitive and the four centuries of stubborn resistance to foreign invaders have left little of tradition available to the present generation. The early Spanish historians have described the Indians of Darien—as the whole of the eastern Isthmus was known—under a great number of tribal names, while the designation Cueva was applied in a comprehensive sense.[10] By many authorities the Darien Indians of the Caribbean coast are believed

Fig. 3—San Blas Indian girls on dress parade.

to belong to the Cuna family, which is of Carib origin,[11] though the San Blas themselves disclaim racial connection with any other tribe.

The San Blas say that they are not original shore-dwellers but mountaineers and that their ancestry once lived in the interior. Early writers

[10] See Oviedo's "Historia General y Natural de las Indias", Book 29, Chapter 26 (Vol. 3, p. 125, of 4-vol. edition of Real Academia de la Historia, Madrid, 1851-55).

[11] Bell, *op. cit.*, p. 626; Prince, *op. cit.*, p. 109; Alphonse Pinart: Les indiens de l'état de Panama, *Revue d'Ethnographie*, Vol. 6, 1887, p. 47. Thomas and Swanton (Indian Languages of Mexico and Central America, *Bur. of Amer. Ethnol. Bull. 44*) are of the opinion that the Cuna language constitutes a stock in itself showing "no clear affinity with any other language, in spite of certain leanings towards Chibcha." See also Karl Sapper: Beiträge zur Ethnographie des südlichen Mittelamerika, *Petermanns Mitt.*, Vol. 47, 1901, p. 25, especially the linguistic map.

intimate that there was a marked difference between these two types—the mountain residents being much wilder, more intractable and hostile than the occupants of the littoral and less given to the arts of agriculture and such semi-civilized pursuits. Even today the dwellers in the San Blas hinterland are as primitive as any in America. They dwell in small settlements and live by the chase, trading meat and forest produce with the sea-island Indians. Little is known of the facts of distributionin the interior. Selfridge[12] found the country back of the Gulf of San Blas uninhabited, but further east he believes the settlements of mountain Indians to be more numerous than generally supposed.

FIG. 4—A San Blas settlement on one of the coast rivers.

STATUS AT TIME OF DISCOVERY

The territory now occupied by the San Blas was densely populated in Columbus' day and until they were decimated by war, slavery, rum, and the diseases brought in by the whites. This is abundantly attested by early explorers and writers, as well as by the fact that the forests on the littoral of the Atlantic in that locality are not primeval but show that the land was once well cleared. The tribes constituting that population were not hostile to the first whites, and in the San Blas region Columbus was well received at the point named by him Puerto Bello. Before the coming of the

[12] Report of Explorations and Surveys for a Ship Canal, Isthmus of Darien, Navy Dept., Washington, D. C., 1874, p. 10.

Spaniards the Indians had developed primitive agriculture to a considerable degree, a fact of great service to the early conquerors. They prized gold and knew how to wash it from the sand of the little rivers in that region.[13] They were probably ignorant of the art of mining gold but doubtless learned this from the *conquistadores*. They were expert hunters, trappers, and fishermen, using the bow, nets, and primitive trapping devices, and they possessed canoes. There is little evidence of any religious cult among them and they had no great temples such as were erected by the great races to the north and south. They were organized into the usual tribal forms, with kings (*caciques*), and they recognized the tribal laws.

FIG. 5—A house showing modern influence at work among the San Blas Indians.

UNINFLUENCED BY HIGHER CIVILIZATIONS TO NORTH AND SOUTH

The early Cuna Indians knew something about the Peruvians, for they stimulated the curiosity of Balboa and of Pizarro by what they said about the gold and the might of the people on the Pacific,[14] but they were not strong enough to react to such curiosity themselves. The Inca civilization was a wonder-rumor to them. They were as little affected by the culture of their cousins four hundred years ago as they were by the whites who brought the wonders of the world to their doors. They had neither the

[13] Lionel Wafer: A New Voyage and Description of the Isthmus of America, James Kempton, London, 1699, p. 31.

[14] Peter Martyr: De Orbe Novo, translated from the Latin by Francis August MacNutt, New York, 1912, Vol. 1, pp. 220-223.

governments, arts, nor the force possessed by the wonderful peoples who made Mexico and Peru splendid before the discovery of America. There are no monumental remains in or near their territory.

Possible Pygmy Race

How and why it happened that these great cultures of the north and of the south were so widely separated, with no intermediate cultural development on the Isthmus of Panama other than the primitive sort presented by the San Blas and similar tribes, constitutes an interesting and somewhat puzzling problem in American archeology. Are the San Blas the remnants of a primitive migration into America of a people less developed than those others, or are they a case of stagnation under the handicaps of their environment? The physical characteristics of the Cuna mountaineers have caused the writer, from his intimate acquaintance with the African pygmies, to incline to the former thesis and to see in them the possible representatives of a pygmy race. The identification of a race of pygmy Indians on the Isthmus of Panama would be intensely interesting to the student of human development because of the light that such a fact would throw on the much-vexed question of the origin and distribution of pygmies over the world. However that may be, the character and culture of the San Blas embrace some very profound studies. There are many speculative questions presented to the ethnologist and the philosophic student of human development in this little colony of aborigines in Panama—one of the most easily studied of the tribes in America now, and one which offers an exceedingly interesting problem in the early history of the hemisphere.

NEW ORLEANS IN EARLY DAYS[1]

By EDNA F. CAMPBELL

The pleasant territory of Louisiana, claimed by La Salle for France in 1682, rapidly acquired such popularity in the mother-country that its possession formed the foundation of the famous speculation of John Law known as the "Mississippi Bubble." The geography of the waterways of this region determined that New Orleans become in the early part of the eighteenth century not only the commercial center for the settlement in the Mississippi delta, but also the point about which population began to concentrate. Monette quotes Charlevoix as crediting the town in 1723 with 200 inhabitants besides troops, 100 cabins, the warehouses of the India Company, and a church. Not being protected by a levee, New Orleans was subject to inundations yearly and, according to an early traveler, looked like a vast sink in which grew a variety of tall grasses and reeds. The streets divided the town into sixty-six squares. Around each ran a ditch for drainage, and, as every lot in each square was also ditched all around, the town seemed like a "microscopic caricature of Venice."

Such was the town that was known in Paris as a beautiful city, for this period saw the climax of the "Mississippi Bubble" and Louisiana was a magic word to send emigrants from France. French pens were taxed to find sufficiently extravagant adjectives to describe this land, so rich with gold that even the thick yellow waters of the Mississippi when filtered yielded an invaluable deposit of the metal, a land which was more than "Old Eden, so long lost to mankind."

When the bubble burst, the opposite extreme was reached, and the name of Mississippi became such a terror that it was said the threat of French mothers to send rebellious children there was all that was needed to quiet them. The burden of the failure fell heavily upon Louisiana, as supplies from France were cut off. The company backing the colony struggled along a few years, but, although emigrants continued to arrive, the charter was rescinded in 1731 and Louisiana became again a royal province.

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[1] The main sources used are:

J. W. Monette: History of the Discovery and Settlement of the Valley of the Mississippi, 2 vols., New York, 1846.

Le Page de Pratz: Histoire de la Louisiane, 3 vols., Paris, 1758.

Charles Gayarre: Histoire de la Louisiane, 2 vols., New Orleans, 1846.

Charles Gayarre: Essai Historique sur Louisiane, 2 vols., New Orleans, 1830.

Historical Collections of Louisiana, ed. by B. F. French, 5 vols.: Vol. 1, New York, 1846; Vol. 2, Philadelphia, 1850; Vol. 3, New York, 1851; Vol. 4, ——, ——; Vol. 5, New York, 1853.

Zadok Cramer: The Navigator, 9th edit., Pittsburgh, 1817.

Philip Pittman: The Present State of the European Settlements on the Mississippi, London, 1770. Reprint of original edition, edited by F. H. Hopper, Cleveland, 1906.

William Darby: The Emigrant's Guide to the Western and Southwestern States and Territories, New York, 1818.

Timothy Flint: The History and Geography of the Mississippi Valley, 2 vols., Cincinnati, 1832.

F.-X. Martin: History of Louisiana from the Earliest Period, 2 vols. in one, New Orleans, 1827.

Louisiana and New Orleans in 1731

Despite a policy unwise in many particulars progress had been made in Louisiana in settlement and development during the fourteen years' existence of the India Company. Colonization was not a national enterprise but a stock-jobbing operation. Thrifty, hard-working, home-seeking people did not dominate among the colonists, and seekers of wealth or adventure, "gentlemen of France," did not consider themselves Louisianans but Frenchmen on a brief sojourn from home.

In New Orleans and vicinity at this time there were about a thousand people. In 1727 a levee was started which was to extend 18 miles on each side of the city, with a summit-level 18 feet wide. A canal was planned from New Orleans to Bayou St. John (where Carondelet Canal was later constructed), and an effort was made, though in vain, to have the woods between New Orleans and Lake Ponchartrain cut, as it was believed that the town would be more healthful if there were freer circulation of air.

Aside from New Orleans, some important settlements had been made at Tchoupitoulas, Cannes Brulées, the German Coast, Bayou Manchac, Baton Rouge, Pointe Coupée, Second Creek, and St. Catharine's Creek at Natchez. The white population in the region was 5000 and the black was 2500 when the India Company resigned its charter. Under the new régime emigrants continued to arrive from France, Canada, and the West Indies. The character of the soil and ease of movement determined their location along the banks of the Mississippi and Red Rivers, as well as along the numerous creeks and bayous.

German Settlers

When the Germans who came to Law's grant learned of his fate and realized that they were abandoned in a distant part of the colony, they descended the Mississippi in a body to go home, but they were prevailed to settle along the river in what are now the parishes of St. Charles and St. John the Baptist, a region first called the German Coast and a century later known as the Gold Coast, because some of the thrifty Germans became wealthy sugar planters. They were industrious, home-seeking settlers, just such as the country needed. They engaged in farming and every Saturday night took their produce 30 miles down the river to New Orleans. It was not long before their German was forgotten and they had adopted the French tongue, but they did not lose their peculiar ability to get the most out of what they had.

Economic Resources

The natural wealth of the region was becoming apparent to the colonists after years of suppression by an unwise colonial and commercial policy. Up to the close of the first quarter of the eighteenth century attention had been given largely to hunting and to trading with the Indians. About that time a change was in progress. Agriculture was beginning to flourish, and lands were becoming so valuable that surveyors were sent to straighten out the land grants.

Livestock

The livestock of the colony included 1100 cows, 300 bulls, 200 horses, 100 sheep, 100 goats, some hogs and hens. The friendly tribe of Indians at Avoyelles was the best source for procuring cattle, some of which the Indians had secured from the Spanish settlements and for which their prairie was well suited. Cattle-raising was significant in nearly every settlement along the river and especially on the small scattered prairies back of the river.

Rice and Indigo

By 1723 Lower Louisiana was growing a few staples, indigo, rice, and tobacco in fairly large amounts. Rice, brought into the valley from Carolina,[2] was an important crop, not only for home consumption but in time for exportation, being extensively grown by 1731. Indigo, first cultivated in 1726, was exceedingly profitable, and hence it tended to exclude other crops for a number of years. From 30,000 to 35,000 pounds of indigo were produced in 1736, and during the last year of French control it was the leading export, the value being more than $100,000 yearly. It was in greater demand than that of Santo Domingo, as it was of better quality and color. The crop was, however, subject to the uncertainties of the weather, and during 1793–94 it was destroyed by great swarms of locusts. Thereafter the cultivation of indigo gradually gave place to that of sugar, cotton, and tobacco.

Tobacco

Tobacco, another great staple of the province, also suffered from the uncertainties of the weather. It was a localized crop, the greater part being grown on the uplands near Baton Rouge, Natchitoches, Pointe Coupée, and Natchez and sent to New Orleans for distribution. To encourage the production of tobacco a bounty was offered by the royal government to buy all the crop at $7 a 100 pounds.

Cotton

Cotton was introduced in 1741, but for a number of years was cultivated in small quantities on almost every plantation for domestic consumption only. It was remarkable for its whiteness but was of a short fiber. Nowhere was it the entire crop of a plantation, owing to the difficulty of separating the cotton from the seed. When a cotton gin was constructed by a planter in 1751, the crop promptly became important.

Sugar Cane

The fifth and last of the great staples introduced was sugar cane. A quantity of cane, together with a number of negroes acquainted with the process of making sugar, was brought in 1751 from Santo Domingo and a small plantation started on the Mississippi just above New Orleans. Within a

[2] *Hunt's Merchant's Magazine*, Vol. 9, 1843, p. 86, New York.

few years the cultivation of the cane was commenced on a small scale in most of the plantations in the vicinity of New Orleans, and in 1759 the first sugar-mill was erected. The undertaking was a failure, for, though the sugar of the province was of fine quality, lack of skill handicapped its production. The supply of sugar was soon sufficient for domestic use, but it was not an export crop till 1795, when sugar planting became more general and when the first shipload went to France. The impetus to extensive sugar planting came from the failure of the indigo crop in the year of the locusts. One of the large indigo producers, to recoup his losses, planted his land in sugar. He prospered and increased his plantation, and his example was followed by others. Indigo culture was gradually thus replaced by that of sugar and other crops.

Lumber

Lumber was a valuable product of the region and rapidly became an important item among the exports of the period, a large amount being sent to the West Indies. New Orleans was the distributing port, and to it lumber was sent easily by way of the bayous which surrounded nearly every plantation and formed a part of the great system of channels connecting with the Mississippi River. As settlement spread to the banks of streams flowing into or away from the Mississippi, lumbering developed along them, especially as the more desirable kinds of timber became somewhat rare. Timber was one of the two leading products of the Plaquemine settlement. The flood waters of the Mississippi furnished the power by which the planters operated their saw-mills.

Cypress was preferred by the French to build their houses, as it was durable, light, and hence easy to carry, and so close-grained that it was not easily damaged by insects. By 1730, however, the easily accessible cypress was becoming rare. The black cedar and the red cedar, especially common along the coast, were considered the next most valuable woods, while the red, white, and live oaks, the ash and the elm, were largely used. Pitch and tar were produced abundantly, especially in the region between the Mississippi and Mobile, which was covered with pitch pine. In 1736 the output of the colony was about 6000 to 7000 barrels, but a larger market was needed. The production of pitch and tar, in connection with the large supply of excellent timber, inspired more than one with the possibility of the colony becoming as great a shipbuilder for France as New England was for England.

Mediterranean Tree Culture

An important product of Louisiana was the myrtle tree, cultivated by nearly every settler for the wax with which to make candles. The myrtle-wax of Louisiana was highly prized at Santo Domingo and was exported to other parts of America, as well as to France. The fig tree and the orange tree were brought from Provence and were common about New Orleans.

Silk Culture

An effort was made, in a small way, to establish silk culture. The mulberry tree was listed as indigenous by writers of the early part of the nineteenth century. This, however, was not the case. It was an "escape from cultivation," probably from Mexico, and, having become "naturalized," grew wild.[3] Some of the settlers believed the climate similar to that of the regions in which it was cultivated at home. There was much discussion in the effort to establish this industry, but, as in the case of shipbuilding, to no purpose.

Other Products

For home consumption, the most valuable product along the banks of the Mississippi was maize, the land yielding as much as 110 bushels per acre. Yam and the West Indian sweet potato were certain crops.

Salt was manufactured along the Arkansas and Red Rivers and supplied at $1.00 to $2.00 a bushel at the works to the inhabitants of Natchitoches and vicinity.

Commercial Development

Specialization in agriculture made commercial development inevitable and was the prime factor in that development. Other factors were the relative ease of communication between the settlements along the great river, the hurricanes that visited the lower region, making aid from outside necessary, and the relations of the port of New Orleans as an entrepôt between Louisiana and France.

Louisiana carried on an active trade with the Indians, with the parent country, and especially with the settlements along the Illinois and Wabash Rivers. The Illinois country was about 1500 miles from Quebec, while it was only about 1100 miles from New Orleans. Breadstuffs were a large item in the commerce with the upper part of the valley. Accounts show Upper Louisiana in 1745 to have sent 4000 sacks of 100 pounds each of breadstuffs. Other articles were beef, pork, bacon, leather, hides, beeswax, and bear's oil. In 1746 the Wabash country shipped 600 barrels of flour to New Orleans besides large quantities of hides, peltry, tallow, and beeswax.[4] Part of the shipments went to the West Indies and part to France, the rest being marketed in the lower country.

Trade between the upper and lower regions began with the coming of a boatload of produce to Lower Louisiana in 1705, but by 1720 the river trade was well developed.[5] It was carried on chiefly in large flatboats, or bateaux, of a capacity of forty tons, each manned by twenty men and equipped with oars, poles, sails, and ropes. Commonly six to twelve bateaux went to-

[3] O. R. Willis: Practical Flora, New York, 1891, pp. 230-231.

[4] B. A. Hinsdale: The Old Northwest, New York, 1888, p. 50.

[5] J. W. Monette: Progress of Navigation and Commerce on the Waters of the Mississippi River and the Great Lakes, *Mississippi Hist. Soc. Publs.*, Vol. 7, 1903, p. 483, Oxford, Miss.

gether for protection, as during this time the English were inciting the Indians to attack the boats. The trip usually took about three months, and two trips were made each year by the little fleet. The return was made about December, and the load then consisted of rice, indigo, tobacco, sugar, cotton, European fabrics, and goods for the Indian trade.

WANDERING STORMS

By ALEXANDER McADIE
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Sir Napier Shaw, director of the British Meteorological Office and, during the war, scientific adviser on meteorology to the British Government, is now engaged with his colleagues in the preparation of a four-volume "Manual of Meteorology." Part I will give a general survey of the globe based upon the work of Hildebrandsson, Teisserenc de Bort, and others; Part II will deal with the physics of the air; Part III will contain a formal exposition of the thermics and dynamics with which modern meteorology deals; and Part IV, which has been issued in advance of the others[1] and is, in a way, a war product, discusses the relation of the wind to barometric pressure and the travel of cyclones. There were so many calls from insistent and impatient aviators that it was thought wise to attempt a general exposition of the probable paths of storms; the relation of surface wind to the so-called geostrophic wind, i.e. the component wind due to the rotation of the earth as distinguished from the cyclostrophic component due to the curvature of the path; the variation of wind with height; turbulence; gustiness; and cloud sheets.

Three Unusual Storms

As a frontispiece to the manual, Sir Napier Shaw uses three storm paths of unusual duration and remarkable recurvatures.[2] The details of these long-lived storms are given in Chapter 10 of the book, and we shall mention only a few facts connected with them.

The first storm is one of the typhoon, or *baguio*, type charted by the writer (Fig. 1). Detected first in latitude 15° N., longitude 148° E., in the western Pacific, on November 20, 1895, we can trace its wanderings halfway around the world. It reached the coast of British Columbia on January 12, 1896, and was stopped in its eastward course by an Alberta "high," or cold wave. Meanwhile the southern disturbance struck the coast of California at San Francisco on January 13 and presumably passed rapidly southeastward. In all probability the disturbance was over the valley of the Colorado on January 14 and merged in a large ill-defined depression following the advancing "high;" but we have not joined the storm centers, as definite data for this large area are lacking. That portion of the storm remaining over California worked its way slowly northward, with a tendency to recurve, but

[1] Sir Napier Shaw: Manual of Meteorology, Part IV: The Relation of the Wind to the Distribution of Barometric Pressure. xvi and 166 pp.; maps, diagrs., ills., index. *M[eteorol]. O[ffice] Publ. No[l]. 234.* Cambridge University Press, London, 1919. 12 s. 6 d. 10 x 7 inches.

[2] The detail with which these storm tracks are shown at sea may at first sight cause surprise. But the fact is that the network of weather-reporting ships, especially along the trade routes, is often as close as that of land stations in an area of the same size. The tracks shown are based upon data published by the Deutsche Seewarte of Hamburg, supplemented by U. S. Weather Bureau and U. S. Hydrographic Office reports.

finally crossed the continent, well to the north, disappearing in the Hudson Bay section on January 20, 1896. If we assume that the southern storm preserved its identity, we find it moving steadily eastward, then northeast over the Atlantic, to disappear south of Iceland about January 22, 1896. This is the longest storm path and longest duration (64 days) yet recorded, but it is quite possible that other disturbances have lasted longer and traveled farther. This storm is also remarkable for the number of recurva-

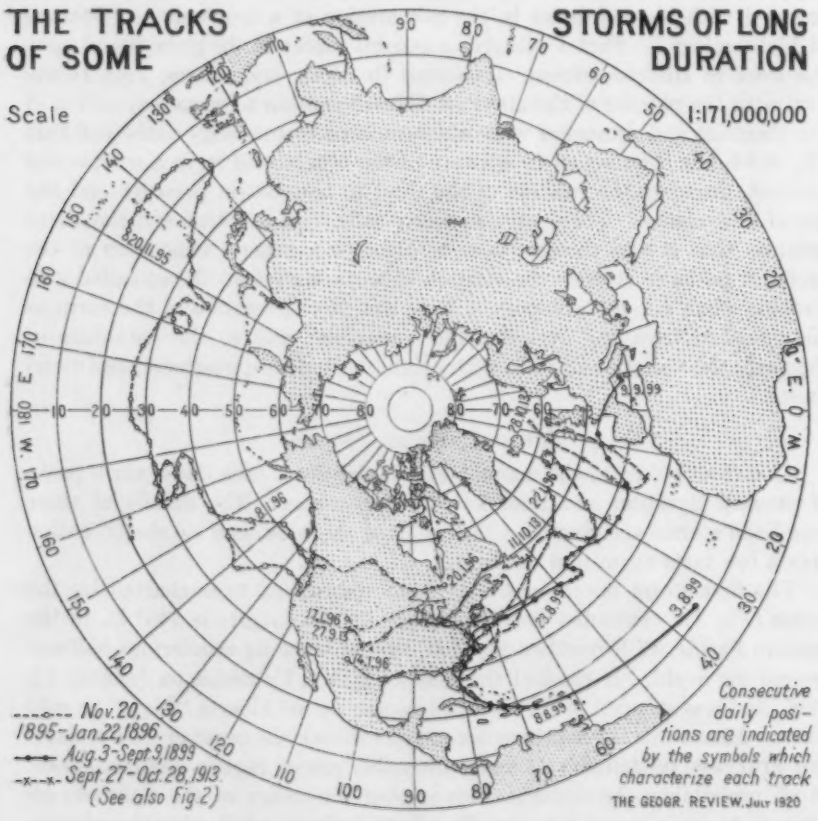
THE TRACKS OF SOME
STORMS OF LONG DURATION
Scale 1:171,000,000
Nov. 20, 1895–Jan. 22, 1896.
Aug. 3–Sept. 3, 1899
Sept. 27–Oct. 28, 1913.
(See also Fig. 2)
Consecutive daily positions are indicated by the symbols which characterize each track
THE GEOGR. REVIEW, JULY 1920

FIG. 1—(Based on frontispiece of Sir Napier Shaw's "Manual of Meteorology, Part IV.")

tures. The resultant force which drives a cyclone eastward in temperate latitudes seems to have been reduced to a minimum several times in the storm's career.

The other storms are of shorter path and duration but of great interest, as they also show erratic paths (Fig. 1). The West Indian hurricane of August 3, 1899, detected in latitude 11° N. and longitude 35° W., recurved five days later off the Florida coast, journeyed leisurely northeast, reached the mid-

Atlantic twenty days after its first recognition, then halting, reversing, and doubling on its own track, finally moved east, passing over southern France on September 8–9 and thence rapidly southeastward across the Mediterranean.

The third storm, so far as can be now ascertained, developed near Great Salt Lake and disappeared near Lapland. Three recurvatures can be identified. After leaving the American continent on October 2, 1913, it pursued a most erratic course and was centered near Ireland on October 21. It then shot southward, missing Great Britain, and for four consecutive days moved at the rate of 600 kilometers per day, that is, 15 miles per hour. Doubling on its track it made an even more rapid and direct north-

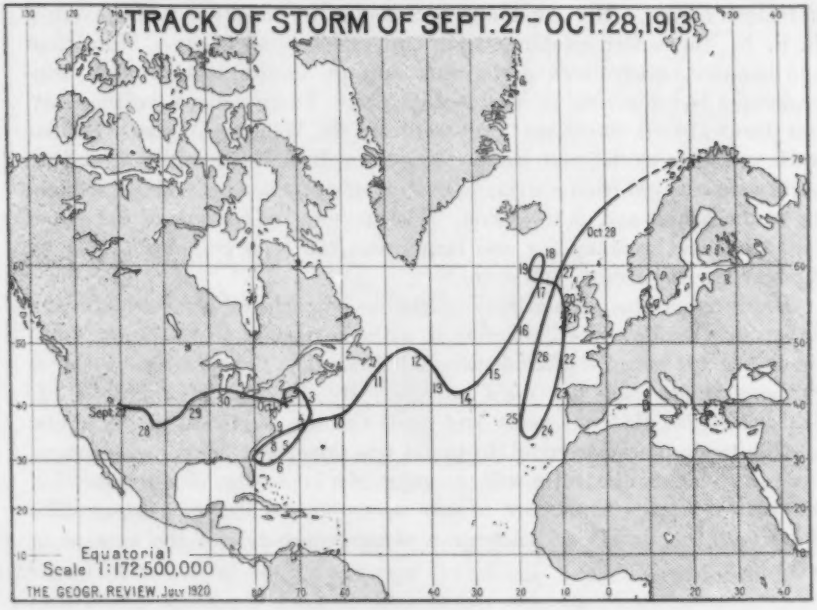

FIG. 2

ing and passed over the Faroe Islands, headed for the Lapland coast. The path is so unusual and has such a bearing upon transatlantic steamship routes that we have plotted it, on a larger scale than that on which it is shown in Figure 1, on a map in Mercator's projection (Fig. 2). One can readily see how a storm like this nullifies the forecasts.

NEED OF ACCURATE AËROGRAPHIC DATA FOR THE AVIATOR AS ILLUSTRATED BY THE TRANSATLANTIC FLIGHTS

Granted that transoceanic steamship traffic requires the fullest possible knowledge of storm tracks, how much more important are accurate aërographic data for airship movements! The airman who attempts a flight

of even limited duration needs much information, while the long-distance flyer simply trifles with fate if he ascends in ignorance of what the map shows regarding the location, path, and structure of an approaching storm. In these days of long flights, like those between England and Australia and even the shorter transatlantic and transcontinental flights, the aviator must "lean, and lean heavily," upon the aërographer. I quote these words because they are the identical words used by Commander J. H. Towers, U. S. N., in charge of the transatlantic flight by the Navy-Curtiss seaplanes in May, 1919, when asking the writer to supervise the aërographic work connected with that flight.[3]

After leaving Rockaway, the first stop in the flight of the seaplanes was in Halifax harbor. Here, on the U. S. S. *Baltimore*, under Captain Cluverius, U. S. N., the writer established an aërographic observatory. More than one hundred observations of the usual surface conditions were made, supplemented by numerous pilot-balloon flights. Twice daily a weather map was drawn, based on extensive reports from the Weather Bureau. Similar work was done at the next station, Trepassey Bay, Newfoundland, and reports were received from a string of destroyers and some battleships, stretching to the Azores and on to Lisbon. The story of the struggle of the planes with wind and weather, fog and heavy seas has been graphically told by Westervelt, Richardson, and Read.[4]

Hardly was this transatlantic flight accomplished before Alcock and Brown in a swallow-like dart crossed without stop, in 16 hours, the 3,115 kilometers between Newfoundland and Ireland. *Favorable northwest to southwest winds made the flight possible.* By the first of July, the big British dirigible R34 was ready and made the trip westward in 108 hours. All that modern science could do to aid was done, and her return passage, made in 75 hours, illustrates well the value of a knowledge of storm location and path. What Commodore Maury accomplished for the clipper ships of his day, the British and American aërographers did for the airships of July, 1919.

Need in Forecasting of Knowledge of Recurving Storms

So the forecaster of today must be on the alert to detect any tendency of the passing storm to recurve. Most storms travel on anticipated paths, though the velocities may vary from ten to forty miles an hour. Sometimes a storm will cross the Atlantic in three days, and again, as we have seen, some require weeks. Some never get across. Of this last class, the most remarkable illustration in a collection of erratic transatlantic storms covering a period of ten years is, in the judgment of the writer, that of May 8 to June 6, 1910.

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[3] Cf. the note "The Meteorological Aspects of the Recent Transatlantic Flights," *Geogr. Rev.*, Vol. 7, 1919, pp. 419-421.

[4] The Triumph of the N C's, Doubleday, Page & Co., New York, 1920.

This storm (Fig. 3) well deserves the name "cyclone," if the term is used in the sense in which Piddington, who coined the word, first used it, namely, the coils of a serpent, for it twists and turns upon itself. We have tracked it from the Strait of Juan de Fuca to the Grand Banks, whence it recurved again and again and came back to the continent on May 26. Here it met and merged with a storm that was moving north from Texas; and the new

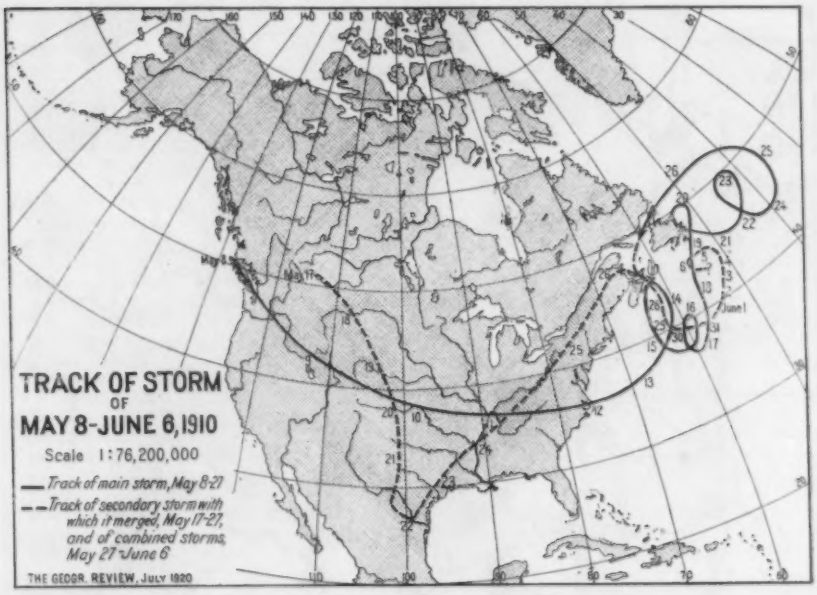
TRACK OF STORM
OF
MAY 8-JUNE 6, 1910
Scale 1:76,200,000
Track of main storm, May 8-27
Track of secondary storm with which it merged, May 17-27, and of combined storms, May 27-June 6
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FIG. 3

combination moved slowly east over Nova Scotia. Notwithstanding this increase of storm energy, the forces compelling a northerly direction—strong south winds due to a marked North Atlantic hyperbar—still prevented progress east; and for more than ten days, until June 7, this "low" remained practically stationary southeast and east of Nova Scotia, dissipating in showers and thunderstorms. In the history of a storm like this will be found eventually the solution of the problem of accurate seasonal forecasting.

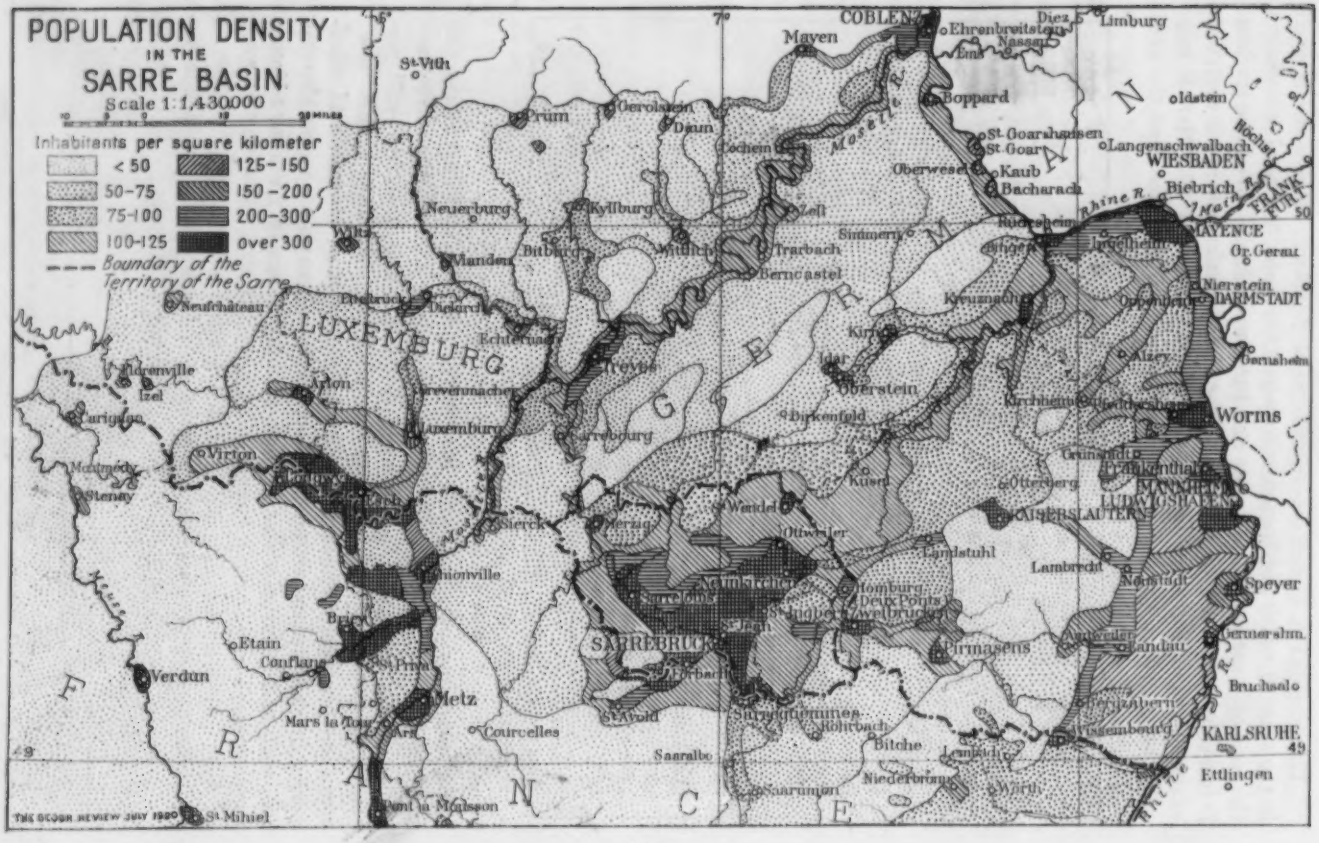

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Fig. 1

GEOGRAPHICAL RECORD

EUROPE

A Population Map of the Sarre Basin and Adjacent Regions. Four papers by Vidal de la Blache and Lucien Gallois in No. 154 of the *Annales de Géographie* (July 15, 1919) comprise a historic and economic study of the Sarre Basin. The fourth paper, "La répartition de la population dans le bassin de la Sarre et les régions environnantes," is accompanied by a colored population density map, reproduced herewith in black and white (Fig. 1). Extension of the area to cover adjacent regions brings out the unity and individuality of the Sarre Basin. On the area thus shown distribution of population is markedly unequal. Such inequality, a relatively recent feature in these lands of old civilization, is the usual resultant of industrial development. Apparently it is to be a law of future population distribution.

On the map three areas of dense population (over 150 to the square kilometer, or about 400 to the square mile) are separated by areas of thinner population, areas in large part occupied by forests, as those of the Hardt and the Hunsrück. Of the areas of dense population that of the Rhine Valley is the most stable, for it rests chiefly on an agricultural basis. The spots of highest density, over 800 to the square mile (over 300 to the square kilometer), are round the commercial centers, Coblenz, Mayence, Worms, Speyer. Ludwigshafen and its environs is the only point of large-scale industry. In the agricultural country it is interesting to note the differences in density coincident with the differences in cultivation. The band of denser population running northward from Weissenburg (Wissembourg) along the hills bordering the Hardt and continuing to Mayence and Bingen is *par excellence* the zone of vine cultivation.

Coal is still the prime factor in industry, and industrial agglomerations are most typically developed on the coalfields. The most compact and dense grouping on the map corresponds with the coalfield of the Sarre Basin (compare the mineral resources map of Alsace-Lorraine, *Geogr. Rev.*, Vol. 6, 1918, opp. p. 112), where the density exceeds 800 to the square mile. This block of high density is surrounded almost completely—except to the south, where it terminates abruptly against the forests of Carlsbrunn and St. Avold—by a zone of population density between 260 and 320 to the square mile (100 to 125 to the square kilometer), also dependent on the coal basin. This transition zone houses workers who come in daily to the mines, the foundries—glass and pottery—and factories by the railroads that thread the valleys.

In some respects the Sarre Basin is industrially unique. There are few such regions where population is so stable and so firmly implanted. An example from statistics lately collected by the French will show this. Out of a group of 3,500 residents, the majority miners or metal workers, 80 per cent were natives of the region and 73 per cent sons of fathers native of the region. In this connection the effects of French exploitation may prove interesting. The Peace Treaty stipulates that "no impediment shall be placed in the way of introduction or employment in the mines and their accessories and subsidiaries of workmen from without the Basin."

It is otherwise with the industrial agglomerations of the Moselle. The grouping here is much less compact and the transition to zones of sparser population more abrupt. The labor includes a very large foreign element, Italian, Flemish, Polish. In the *arrondissement* of Briey foreigners outnumber the native population. The intense industrial growth has been of recent date. It began with exploitation of the Briey mines in 1880 and introduction of the basic process of steel manufacture. Transformation has been too rapid. The consequent maladjustment between man and the soil is something quite foreign to France.

The Influence of Geography on the Conduct of the War. The importance of geography as shown by the war formed the subject of an interesting discussion at a meeting of the Geography Section of the Educational Congress held at Harrisburg, Pa., November 17–22, 1919. Mr. Alfred H. Brooks of the U. S. Geological Survey presented a paper entitled "The Influence of Geography on the Conduct of the War," in which he gave a broad classification of the various factors involved ("Proceedings of Educational Congress, November 17 to 22, 1919," Dept. of Public Instruction, Commonwealth of Pennsylvania, Harrisburg, Pa., 1920, pp. 540–547). Mr. Brooks served as Lieutenant-Colonel of Engineers and Chief Geologist of the American Expeditionary Force. A brief summary of his discussion follows.

The making of war is largely a matter of applied geography. The conduct of war includes (1) military field operations, or the manoeuvering of armies, and (2) the supplying of armies, both of which are to a great extent controlled by geographical factors, such as relief, drainage systems, population, and natural resources. Though the following classification is primarily geographical, an attempt is made to indicate the most important military bearing of the various factors by classifying them under three heads: (1) those influencing general military policy; (2) those influencing the strategy of the campaign, the general plan of operations; (3) those affecting tactics, the details of operation in the face of the enemy.

In determining the general military policy, the prime factors are those of population and natural resources. The significance of the total population needs no comment, while its distribution and density have a very considerable effect. Wide distribution and a lack of homogeneity in the population are decided military handicaps, while a high degree of density of population, if in rear areas, is an evident advantage, though in the immediate theater of war, as in France or Belgium, it hampers defense. The adequacy of the natural resources available for the needs of the population and the fighting forces must also influence policy. The cessation of imports due to the Allies' control of the sea routes put the Central Powers at a great disadvantage because of their lack of several essential minerals and the insufficiency of their agricultural resources.

In all phases of strategy, or the general plan of campaign, the dimensional factor is of prime importance. To give only two of the obvious examples, the width of the zone of operations determines the number of troops necessary, while the length of the line of communication between the front and the supply base is a vital consideration. In this connection it is interesting to compare with our own the length of the line of communication between Germany's front and her source of supplies. However, it is in such physical features as the coast line, relief, and drainage systems that the full significance of the dimensional factor is most apparent.

The length and nature of the coast line, the character of adjacent waters, and the harbors must determine the mode of defense or attack. The long coast line of the Allies was difficult to maintain and, indeed, necessitated naval control. On the other hand, Germany's base on the North Sea, with its adjacent shallow waters and winding approaches, could be held with little effort, while the easily defended entrance of the Baltic (Kattegat) practically rendered it a German sea, thus giving the Central Powers access to the resources of Sweden and Norway. Again, Russia's lack of an open port on her European frontier and the consequent want of contact with her allies was a decisive factor in her military downfall.

The importance of the dimensional factor is again evident in relief, especially in the larger features of relief. The extent of mountain ranges, the symmetry of the ridges, and the character of crest lines, whether continuous or broken by passes feasible for military operations, must control strategy. An excellent illustration of this is afforded by a comparison of the great Alpine chain with the Carpathians, whose length is cut across by many passes, or with the short range of the Vosges, having routes of approach around both sides. An unbroken plateau, such as the central district of the German African colony of Cameroons, is easy to traverse once the summit is attained, while a plateau broken by numerous valleys affords a difficult terrain for military operations. Swampy lowlands greatly hamper the manoeuvering of armies, while naturally well-drained lowlands facilitate troop movements.

An important rôle in strategy is played by the drainage system in the theater of operations, its direction relative to the zone of advance or retreat, the spacing of its streams and the location of its divides. On the eastern front the tide of battle swept back and forth across the principal waterways, and each river offered a locus of resistance and an obstacle to attack, while on the west the German invasion followed up the tributaries of the Rhine. The irregular topography caused by close spacing of watercourses, as in the Argonne of northern France, is admirably adapted to defense, but the more broadly spaced interstream areas, as in northeastern France, permit of the rapid advance of attacking troops. In the highlands a more feasible line of defense is found where the watersheds coincide with the crest lines, as in parts of the Alps, rather than where the upper valleys head back of the mountains. A natural feature of this latter type was utilized by the Rumanian army in its invasion of Hungary, when the Rumanian offensive followed up the gaps in the Transylvanian Alps formed by the valley of the Alt River, whose headwaters lie back of the mountains. The dimensions, the slope of the walls, and the physical character of the valley floors will also evidently exert an influence on military operations, though this influence will be felt more on details of troop movements than on general strategy.

The tactics of modern warfare are largely controlled by physical features. The heavy equipment of modern armies, the use of airplanes and balloons, and the employment of poison gas demand that the details of military operations take into account

such governing factors as watercourses, surface formation, climate, and vegetation in the war area. Not only the dimensions, but also the volume and velocity of streams and their rate of fluctuation (varying according to the season of the year) are important because the ease or difficulty of crossing a river with infantry, artillery, and tanks may be a decisive element in a given battle.

The physical conditions of the surface formation controls the movements of heavy artillery and tanks, which can be manoeuvered only on fairly hard ground; and a heavy soil and subsoil, if porous, may become impassable for such troops during a rainy season. Again, the construction of field works, such as trenches, dugouts, and mines, is affected by the condition of the soil and subsoil, as well as by the depth to ground water; and where such conditions are adverse, as in the plains of Flanders and on many of the Russian battlefields, elaborate defensive works are impracticable.

Climate is chiefly important in tactical movements, though the seasonal temperature affects the general plan of campaign, and a similar control is exercised on strategy by extremes of seasonal precipitation. The use of airplanes and of poison gas has made the direction and velocity of wind and the magnitude and frequency of storms important. The airplane and balloon observations of modern war have also rendered significant the distribution of vegetation, whose chief value consists in affording cover for troop movements.

It is difficult to make choice of the geographical factors significant enough to set forth in such a brief presentation, and the limited space makes it impossible to cite examples of the many influences, but the student of the geography of the war, by the use of good maps, can find many applications of the principles here set forth. This note, however, may serve to emphasize the existing relationship between the art of war and the science of geography.

The Meteorological Service of the German Army During the War. Translations of German documents containing accounts of the meteorological work carried on by the German army during the war bring to light many interesting facts not hitherto known (*Monthly Weather Rev.*, Vol. 47, 1919, pp. 871–874). It is evident that special attention was paid to meteorological conditions when gas shells were to be used. The usual decrease in wind velocity during the night led to the use of such shells chiefly in the early morning hours. For the use of gas mines, nights were chosen when the air was not completely calm, but when there was a gentle wind blowing towards the enemy lines. The wind directions in central Europe, arranged according to their frequency, beginning with the least frequent directions, are given as SE, S, E, NE, N, NW, W, SW. The marked prevalence of westerly winds is thus emphasized. "For firing the gas," an official German document says, "it is not always necessary that the wind blow absolutely against the enemy perpendicular to our trenches; a variation as great as 60° from the normal is permissible." The gas being heavier than air, a terrain sloping toward the enemy was more favorable than a flat surface. During a gas attack, observations of wind direction were made continuously and of wind velocity every half hour. A sample report, issued by the army meteorological service, for a position facing the west, is the following:

"You do not need to fear a gas attack today, for we can count on a gentle east wind; on the contrary, it will be possible that during the morning the enemy may make a gas attack, for a complete calm is forecast for that time. This applies especially to the places where the slope rises toward the enemy."

The evidence contained in the translations of these official reports shows very clearly, as was indicated in several of the articles published by the writer of the present note during the war, that the German military meteorological service was a highly efficient organization, which was a very distinct assistance in planning, and in carrying out, military strategy of all kinds.

R. DeC. WARD

ASIA

Climate and Human Efficiency in Korea. Dr. J. D. Van Buskirk of the research department of the Severance Medical College at Seoul, Korea, has for several years been engaged in "a study of the physiology of the Korean people." In this he has paid special attention to diet and climate. The results of his climatic studies appear in the *Transactions of the Korea Branch of the Royal Asiatic Society*, Vol. 10, 1919, No. 15. He begins by giving much the best summary of the Korean climate yet available. Atmospheric pressure is dismissed as of only minor importance so far as the direct effect on man is concerned. Seasons, temperature, humidity, rainfall, storms, winds, sunshine, and clouds, however, are all considered, and valuable tables are given. The most marked characteristics of the climate are the cold, clear, bright win-

ters with considerable variation from day to day, and the warm, rather humid and cloudy summers with little variation from day to day.

Turning to the effect on man, Dr. Van Buskirk finds that so far as mean monthly temperature is concerned there is no great difference in the effect of the climate in Korea and the eastern United States in similar latitudes, that is from Wilmington, Del., to Portsmouth, N. H. But "there is a difference in favor of the United States on account of the humidity and lack of storms and variability in . . . . Korea. It is the feeling of almost everyone when he first arrives in Korea from the United States that the climate is very fine, but before many months have passed we all find it hard to keep up ambition and energy, and it is matter of common knowledge that we do not recuperate so quickly here as in the homeland." Among other troubles neurasthenia is common. "It is not alone this running down of Americans. . . . . the impression gained by even casual observers is that the people of Korea are not . . . . of great vigor. . . . . Many factors would each partially account for this, but . . . . climate is one important factor." The summer conditions of "humidity, lack of the stimulus of changes—lack of 'weather'—and possibly the excess of light" react, or else fail to cause a reaction, "and the very physical tone of the body is reduced." When we compare the people of northern and southern Korea, "there is a difference in favor of the Korean from the northern part. . . . . In this, too, climate forms an important but not the only factor."

Dr. Van Buskirk's study of the Korean climate is an excellent beginning. It will be greatly strengthened when the human side is worked out as carefully and as statistically as the climatic side. Perhaps a correlation of climatic conditions with deaths and hospital cases, together with daily tests of the strength of individuals, would give the desired information. One of the greatest needs today in the field not only of geography, but of medicine, anthropology, sociology, economics, and history is a fuller understanding of the part played by health and energy in determining racial or national character.

ELLSWORTH HUNTINGTON

POLAR REGIONS

On the Sudden Discharge of Icebergs from Greenland's Fiords. To the first number of *Geografiska Annaler*, the new journal of the Swedish Anthropological and Geographical Society, to which reference was made in the preceding number of the *Review* (Vol. 9, p. 368), Morten P. Porsild, the director of the Danish Arctic Station at Godhavn, Greenland, contributes an important article on the so-called "outshooting" of icebergs from the Greenland ice fiords, a phenomenon characterized by a sudden, catastrophic discharge of great volumes of ice from certain fiords (Om de grönlandske Isfjordes saakaldte Udskydning, *Geogr. Annaler*, Vol. 1, 1919, pp. 149–157). The phenomenon has been recorded several times, and the term has become a part of glacial terminology among the Danes and Eskimos, but the process has never been well understood. Herr Porsild after many years' observation and study offers the following explanation:

He divides the ice fiords into types, with gradations between: the Torssukatak type, named from Torssukatak Fiord and characterized by a long-continued, quiescent winter period and a brief summer period, interrupted by a single catastrophic discharge; and the Jakobshavn type, named after Jakobhavn Fiord and characterized by no definite winter or summer period and numerous sudden discharges.

After carefully weighing the evidence he has collected and studying his observations, Herr Porsild concludes that the phenomenon is caused by great masses of water dammed up behind and under the ice, which in times of abnormal melting—as during the prevalence of the Arctic föhn or the summer freshets—accumulates in such abnormal quantities that it finally disrupts the glacier front and forces incredible masses of ice out to sea. He states that every spring he observes a similar phenomenon on a small scale in a little alpine brook that tumbles down the precipitous mountain slopes near his station.

The two types of fiords result from differences in the glacier bed and the basin that it occupies; the number of tributary branches; the capacity of the fiords; the character of the outlets; and the rate of accumulation of the icebergs off the face of the glacier.

Resulting from his firsthand, careful observations, and written in Herr Porsild's clear and illuminating style, the article constitutes a most valuable contribution to the literature of glaciology and geography and merits the attention of every physiographer.

W. ELMER EKBLAW

MATHEMATICAL GEOGRAPHY

Quantitative Mapping by Natural Regions. In an article entitled "A New Method of Mapping Complex Geographical Features Illustrated by Some Maps of Georgia" (*School Science and Mathematics*, Vol. 18, 1918, pp. 699–708) Dr. Roland M. Harper describes a method which, when perfected, may prove of much practical value. The gist of the method is to determine for each geographical province the percentage of each of the things to be mapped and then to insert the names in order of their importance with proper indications as to the amount of each. For example, suppose we desire a forest map. Data are collected as to the percentage of trees of each of the main kinds as determined by actual counts such as Dr. Harper has made in each of the natural regions of Georgia, and the names are inserted in each province in the order of their importance. Such a map tells far more about the actual forest than do any of the types of forest maps now available except those on a very large scale, where each individual area can be shown. Or take crops as an example. In the "wire-grass country," which forms a belt running southwest from a point about half way from Augusta to the sea, the crops fall in the order indicated in column 1; while in the next two regions to the southeast, namely the "flat pine lands" and the "coast strip," the order is as shown in columns 2 and 3 respectively:

(1)	(2)	(3)
Wire Grass Country	*Flat Pine Lands*	*Coast Strip*
Cotton	Cotton	Corn
Corn	Corn	Cotton
Sweet Potatoes	Sweet Potatoes	Rice
Peanuts	Sugar cane	Sweet potatoes
Sugar cane	Peanuts	Sugar cane
Vegetables	Oats	
Oats		
Hay		
Cowpeas		

A series of black-and-white maps giving in this way not only the crops, but the percentage of different kinds of soil, trees, manufactured products, and perhaps other things would give a fuller idea of each natural region than do the highly colored and complex economic maps which now are attempted, but which are too confusing for ordinary use. If lines were added in each province showing the relative amount of each of the items named in the map, the value would be still greater.

ELLSWORTH HUNTINGTON

PHYSICAL GEOGRAPHY

The Climatological Aspect of Radiation. Dr. C. Dorno, on becoming a resident of the high mountains in Switzerland fourteen years ago, "was soon convinced that radiation there presented one of the most important climatic factors," which had been guessed at rather than accurately measured. With a zeal that has raised him to a position of recognized authority on solar and sky radiation he set about measuring "the well-known chief effects of radiation, namely calorific, luminous, chemical, and bactericidal." His results of many years—of wide applicability, but especially in medicine and ethnography, because of their bearing on heliotherapy and human pigmentation—Dr. Dorno has now presented in interesting, non-technical form (On Observations of Solar and Sky Radiations and Their Importance to Climatology and Biology and Also to Geophysics and Astronomy, *Monthly Weather Rev.*, Jan., 1920, pp. 18–24 [translation]).

From the unquestionable physiological importance of solar radiation and the fact "that the differences in absolute amount of radiation and in distribution through the day and the year, from place to place, are far greater and, therefore, more characteristic than those of the other meteorological elements . . . . it might be concluded that for different climatic effects radiation (both incoming and outgoing) is among the most decisive elements." Solar radiation differs widely in its ray elements even at the same place, and for the same solar altitude and apparent clearness of the sky. "The spring sunlight is—at least on the Alpine heights—much richer in heat rays, that of autumn much richer in the ultra-violet ones." We are accustomed to think of sky-light as being a definite, though changing, percentage of direct sunlight: on the contrary the relation is by no means simple. "With middle sun elevations and cloudless sky the red light of the sun falling on the horizontal surface is found to be 14 times stronger than that from the sky, while its brightness is only 11 times stronger, its chemical rays only 4.4 times, its pure ultra-violet (bactericidal) rays even less strong than those of the sky (only about half so powerful)." Evidently, when we speak of "sunlight" we are using a broad generalization. CHARLES F. BROOKS

HUMAN GEOGRAPHY

Wind Maps for Aviators. Mention of new developments in plotting the direction and force of air currents recalls the work so successfully initiated by Lieutenant M. F. Maury in 1847. The publication, in that year, of his "wind charts" ushered in a new era of navigation, since prior to that date mariners had been unguided in the selection of their routes save by tradition and their individual experience. Following Maury's lead, Brault, Buys Ballott, Fitz Roy, and others perfected the undertaking, until now the surface winds over the ocean are mapped in detail on the "pilot charts" of the leading maritime nations. With the advent of aërial navigation it becomes necessary to extend that work so as to cover not only the ocean but the land, and to map the course and velocity of winds at varying altitudes as well as surface currents. Data for the use of aviators had already been collected in several European countries before the war brought aviation to its present development (see note in the *Bull. Amer. Geogr. Soc.*, Vol. 42, p. 530), and in America Professor A. Lawrence Rotch (in collaboration with Andrew H. Palmer) had published his "Charts of the Atmosphere for Aeronauts and Aviators" (New York, 1911). But such studies either covered small areas or were very much generalized. Rapid progress was made during the war, and recently some of the wind maps prepared have been published (see "Les cartes des vents à l'usage des aéronautes" by J. Rouch, Chef du Service Météorologique de la Marine, and L. Gain, *Rev. Gén. des Sci.*, March 30, 1919, pp. 168–171). Three maps of the western Mediterranean are reproduced in this article, one showing surface air currents, another those at 1000 meters, and the third those at 2000 meters altitude. Wind roses, showing the frequency of principal winds and their force according to the Beaufort scale, are given on each map for ten different stations about the coasts. The value of such maps is patent. They will be of even greater service to aviators than are the pilot charts to sea navigators, since the former enjoy greater latitude in the choice of routes and are able to make detours either horizontally or vertically in the ocean of air in order to obtain the most favorable or least contrary winds. The maps show clearly that an aviator traveling between two points may find it advantageous to go at one elevation and return at another, either because he finds the air currents at different levels moving in opposite directions or because they blow with different velocity at varying altitudes. For example, the journey from Oran to Tunis should be made at about 2000 meters elevation, thus gaining the assistance of a strong westerly wind, while the return should be made at an altitude of less than 1000 meters, where the westerly blows with greatly diminished force. Similar conditions are found in most localities, emphasized where topography exerts a marked influence on surface currents or where the passage of cyclonic disturbances interrupts temporarily the general circulation of the atmosphere. Seasonal variations in the movement of air currents are so pronounced and the aviator's dependence upon these currents so great, in order that he may travel with least expenditure of time and power, that wind charts will have to be issued frequently, perhaps more frequently than the monthly issues of the pilot charts.

For the construction of these wind maps the organized co-operation of aviators will be required, since each chart entails the correlation of very numerous data. The wind chart which forms Plate I in Maury's "Physical Geography of the Sea" (New York, 1855, p. 70) is said to have been the product of 1,159,353 separate observations on the force and direction of the wind and of more than 100,000 observations on the height of barometer at sea. The collection of data sufficient for satisfactory charts of winds at different altitudes will be possible only with the assistance of a great number of observers, organized under some such arrangement as that effected by Maury or by the British Admiralty which in 1850 made it obligatory for masters of ships to keep a uniform log and report the results of their observations to the Hydrographic Office.

Climate and Evolution

Ellsworth Huntington. **World-Power and Evolution.** 287 pp.; maps, diagrs., bibliogr., index. Yale University Press, New Haven, 1919. $2.50. 9 x 6 inches.

Dr. Huntington has given us another stimulating discussion of climatic influences. Whereas formerly he has concerned himself chiefly with space relationships, he now undertakes to outline the importance of climate to evolution. In his own words, "the problem of the effect of the physical environment upon human progress . . . . is considered in its relation to time" (Preface, p. 1).

In order to handle his problem, the author has taken a long view of evolution, which he has measured with the pendulum of climatic changes, borrowed for the purpose from his earlier dissertations on the subject. The matter brought over from former studies is amplified by additional data. These data are derived from numerous and diverse fields of knowledge, and the conclusions which are drawn from them are woven together with the brisk skill which we have learned to expect from Dr. Huntington.

On the basis of a statistical study of variations in the death rate, success of applicants taking Civil Service examinations, consumption of alcoholic liquors, school attendance, bank clearings, general prices, national bank deposits, immigration, and yield of crops is evolved the hypothesis that waves of prosperity and of adversity are directly impelled by variations in the health of a community. A detailed investigation of the death rate of nineteen separate places in relation to the temperature, humidity, and variations of temperature and humidity of those places is adduced to show that health varies with fluctuations in the weather—directly, markedly, and in accordance with certain recognizable principles. To fortify these conclusions a chapter is devoted to a discussion of the results of several experiments with schoolrooms of different temperature, humidity, and variation.

After carefully and at length laying the foundations for his thesis, the author begins upon the superstructure, which is the product of an equally extensive search for materials. A number of biological experiments are quoted to illustrate the principle and the conditions of mutation among lower types of animals; and certain anthropological and sociological data are recapitulated to bring out the fact that mutations have occurred and are occurring among men. The results of all these experiments are referred to the common denominator—climatic change.

Finally, Rome, Turkey, and Germany are selected as examples of units which illustrate the workings of the hypothesis. The data for Rome are furnished by history and measured by the results of the author's study of the growth of big trees in California; Turkey is treated chiefly in the light of personal experience and a study of climatic changes in past centuries in Western and Central Asia; Germany is viewed as a present and future world problem.

From the foregoing recapitulation a suggestion of the scope of the work may be derived. Covering in the space of 250 printed pages the tremendous dynamic swing of the eons and the vast intricacies of several fields of human knowledge, it must in the nature of things be open to attack as superficial. Doubtless the author would be the first to admit the weakness of his position. At any rate he candidly acknowledges the limitations of accessible material on which conclusions are based, and he is at great pains to describe in detail the exact statistical methods used in arriving at those conclusions. As a matter of fact, this very care results in overloading parts of the text with methods (e.g. pp. 91–94), and, although there is obviously a sincere attempt to elucidate the use made of statistical material, it curiously enough has the unfortunate effect of causing the reader to wonder if the facts are as relevant and as valuable as they seem. Amplification of appendices to include all such technical information would have obviated these criticisms.

It seems clear that Chapters 1 to 6 contain the important contribution of the book. In these hundred pages the results of huge masses of statistics are marshaled for a definite purpose, and a logical conclusion is deduced from them, viz.: (a) that climatic pulsations have marked effects upon health, which in turn has much to do with such matters as waves of inebriety, financial crises, and economic and social progress in general; (b) that variability of weather and climate may be a factor of the utmost importance in stimulating a population to the highest achievements, whereas lack of variability may tend to keep a social group at a low level of development.

In the three chapters which close the book, Dr. Huntington, as mentioned above, selects three states as illustrations of "the effect of physical environment upon human progress" (p. 1). The worth of the chapter on Germany is impaired by the fact that it was written while the United States was still actively campaigning against that nation, and therefore shows unfortunate traces of a very natural and pardonable animus. The discussion of Turkey wells up from the author's deep personal experiences and is therefore picturesque and heartfelt; it does not, however, advance the solution of his problem much beyond the point reached in his earlier works on the Near East. The chapter on Rome is open to at least three sweeping adverse criticisms. First, patient and detailed research into the writings of the ancients has failed to reveal any marked "downward sweep" of climate in the Mediterranean region within the period of written record, whereas there is wholly adequate proof that some parts of the basin were in general at least as lacking in moisture in ancient times as now (cf. E. C. Semple: The Ancient Piedmont Route of Northern Mesopotamia, *Geogr. Rev.*, Vol. 8, 1919, pp. 153–179). Furthermore, it is certainly quite unnecessary to struggle to uphold a topheavy climatic hypothesis in order to explain much of Roman history in terms of geography. It is, for instance, clear enough from the experience of farmers on our own Great Plains that a few years of unusually dry weather has been enough to drive them to better-favored lands, and of farmers over the world that the removal of watershed forests in any region which approaches the lower limit of adequate rainfall is likely to result at times in an insufficient water supply in the dependent lowlands. Both these conditions were marked in certain periods of Roman history. It is likewise obvious to every student of historical or political geography that geographic conditions which may be, on the whole, favorable to a population in an early stage of development may come to cramp that population and prevent or retard progress at a subsequent period. Rome stands as a conspicuous example of this principle. Time and again her statesmen were forced to cast about for new means of solving problems arising out of her dynamic activity in a restricted area, and it is little wonder that unrest and decadence are recurring phenomena in Roman history. In the third place, it seems to be generally agreed by students of social science that human motives and human progress or retrogression cannot possibly be explained on any single ground, not even so broad a field as geography as a whole, much less on one or two phases of climate. Dr. Huntington himself warns the reader on this point in his opening pages—but he seems occasionally to forget the warning.

The third (middle) major division of the book undertakes a discussion of prehistoric evolution in terms of climatic changes. That there have been climatic changes in the geological past is certain. There is likewise evidence to show that changes of environmental conditions affect the metabolism of animals. But to attempt to relate the two in our present state of information results in awakening admiration for the audacity of the author and vigorous suspicion of the validity of his findings. It would seem that geologists, biologists, and anthropologists have much spade work to do before geographers can make effective use of their materials in this suggestive and enticing field of research.

In style, in clarity of presentation, and in typographic attractiveness the book approaches the ideal. No worker in the field of human geography can fail to be stimulated by a perusal of it.

D. S. Whittlesey

The Pan-Turanian Problem

M. A. Czaplicka. **The Turks of Central Asia in History and at the Present Day: An Ethnological Inquiry into the Pan-Turanian Problem, and Bibliographical Material Relating to the Early Turks and the Present Turks of Central Asia.** 242 pp.; map, bibliogr., index. The Clarendon Press, Oxford, 1918. 9 x 6 inches.

The subtitle of this book is indicative of its purpose. The question of the political future of Central Asia, a pivotal area in the world's history, becomes of increasing import as to its ancient strategic significance is added increasing significance of its natural riches (see Appendix A for a summary of the resources of Central Asia). Any movement attempting to bring such an area under a single political power perforce seeks justification. Pan-Turanian propaganda has claimed racial unity and the desire for national unity as a basis. On the merits of this claim Miss Czaplicka throws light by an analysis of archeological, historical, and ethnological data of the peoples speaking Turkic languages. Her conclusion is thus expressed: "To speak of the Osmanlis and the Turanian Turks as a racial and cultural unity would be by a stroke of the pen, or by means of a propagandist pamphlet, to wipe away all the invasions, migrations, massacres, and fusions which for twenty centuries have played havoc with that part of the world."

The analysis, occupying only some hundred pages, is of course highly condensed. As an introduction to it one might well use the review—an outline sketch—by H. H. Howorth (*Nature*, 1919, No. 2611, Vol. 104, Nov. 13, pp. 273–274). The second half of the book, another hundred pages, is a bibliography given as "a starting point for further research." Naturally most of the works are in Russian.

The Freedom of the Seas

Louise F. Brown. **The Freedom of the Seas.** xvi and 262 pp.; bibliogr. E. P. Dutton & Co., New York, 1919. $2.00. 7½ x 5 inches.

This is a concise and brilliantly written history of one of the most difficult of international problems. The phrase "freedom of the seas" has been in everybody's mouth during the last five years without any general understanding of what it implies, and without appreciation of the fact that it has been similarly debated on the occasion of every war for the last five hundred years. It was on this issue that we fought for independence in the eighteenth century; that we fought England in 1812; and that we entered the world war in 1917.

Literally interpreted, "freedom of the seas" would mean the complete immunity, from capture or molestation, of private property on the seas at all times. It would also mean that trade might be conducted everywhere without discrimination of nationality or without the impediment of protective tariffs—in this sense implying "free trade." But the term has never been used as connoting complete immunity or comprehensive free trade. It has been employed, almost exclusively, in the form of protest. "When the question has been raised in the past there lay behind it either resentment at inequalities of opportunity in overseas markets or jealousy of the power that controlled the seas" (p. 237).

When Portugal and Spain opened routes to the Indies, it was natural that they should seek to monopolize those routes. The other maritime nations, such as France, England, and Holland, refused, however, to accept this doctrine and fought for "the freedom of the seas" to the extent of their power. Nevertheless, the theory of exclusive or special rights in sea areas has been maintained down to the present time. It was not until 1859 that the tolls imposed by Denmark on ships entering the Baltic Sea were abolished. The United States claimed the Bering Sea as a *mare clausum* in the eighties, though it had protested a similar claim on the part of Russia in 1821. In the late war, the right to monopolize portions of the sea was exercised by the sowing of mines and the proclamation of danger zones.

It is in regard to interference with commerce in time of war that the most bitter and irreconcilable differences have arisen. In such circumstances, belligerents and neutrals have equal interest in the questions of contraband and blockade, of right of search, and of the disposition and destruction of prizes. In the war "neutral commerce has been interrupted to an extent unprecedented in any previous war, and the sea lanes have been made unsafe for travel in a way that makes the days of piracy seem days of gentle usage" (p. 229). The great difficulty has been that agreements on rules to be followed during hostilities have been practically impossible of attainment, since any nation will agree to concede only what it thinks it can yield without weakening itself as a belligerent.

The term "freedom of the seas" has also been used in protest against limitations and restrictions placed upon commerce in times of peace. Thus, "with the development of modern industry, as colonies increased in importance as sources of raw materials and profitable fields of investment, the old desire to guard them for the benefit of nationals grew strong again. Mercantilism revived in new forms. . . . The extension of our navigation laws, which meant our coasting trade monopoly, to our oversea possessions, gave rise to suggestions on the part of Englishmen that it might be desirable to re-enact the British navigation laws" (p. 245).

The position of England on all these questions has been determined by the fact that for centuries she has been the paramount naval power. "The nation that rules the waves today," says Miss Brown, "is the nation that ruled them in the days when France tried to wrest the trident from her. She claims, and with justice, that she has used her power to make and keep the seas free in time of peace. In time of war, she does not hesitate to state, the seas must be closed to her enemies. When, as in the war just ended, her enemies are the enemies of all freedom, criticism is dumb. But it will not remain dumb" (p. 237). It must be evident, indeed, to any reader of this fascinating book that the only reasonable solution of these most difficult questions is international control of the seas through the establishment of a league of nations.

Frederick J. Teggart

Two Modern Regional Geographies of Germany

Willi Ule. **Das Deutsche Reich: Eine geographische Landeskunde.** xi and 546 pp.: maps, diagrs., ills., bibliogr., index. Friedrich Brandstetter, Leipzig, 1915. 9 x 6½ inches.

Gustav Braun. **Deutschland, dargestellt auf Grund eigener Beobachtung, der Karten und der Literatur.** Vol. 1, xi and 383 pp., bibliogr., index; Vol. 2, xv pp., maps, diagrs. Gebrüder Borntraeger, Berlin, 1916. 10 x 6½ inches.

Almost simultaneously there have been published two books on the regional geography of Germany by occupants of the chair of geography at two German universities. It appears immediately that unity of opinion as to the essential content of geography is no nearer among German geographers than it is in this country. The volumes overlap only in a small bit of material that is common to both, and they show that the geographer does not find himself much more seriously limited by his topics than the minister in the pulpit by his text.

The volume by Ule is easy to use. First of all it is so simply arranged that we can refer easily to any natural region or to a factor in the environment. It is useful also, because one can find in it everything that any encyclopedia presents on Germany, and more. It is an attractive book, with nearly a hundred well-selected and adequately described half-tones and various maps in addition. It is readable, for the author writes with spirit and in numerous places achieves rather fine descriptive passages. The book is convenient and valuable for reference purposes.

Ule's "Deutsches Reich," however, is not an important contribution to geographic literature. It breaks no new ground. It is essentially a conscientious compilation without a critical discrimination of material. The author apparently subscribes to the idea that geography is concerned with the special distribution of things. He seems to be without an adequate definition of geography. He is fearful of omitting something that might find a place in a geographic study, and accordingly he has loaded the volume with a great variety of material the relevancy of which is in doubt. Much of its contents is appropriate enough in a Baedeker, but hardly in a geography. The names of churches, public buildings, and points of interest in cities are given at length. The dress of peasants is described in detail. The fauna is listed even down to the mention of fifteen names of butterflies and moths. There is a great deal of this kind of information, commonly presented in a casual manner. Butterflies are mentioned as butterflies, not as part of an ecologic study. Even were they presented in an ecologic setting, should they find a place in a 500-page volume dealing with the conditions of livelihood of 70,000,000 people? The chief criticism of Ule's book is that there has been no sufficiently critical sifting of the material nor an adequate presentation of its geographic bearings.

Braun disclaims the intention of writing a monograph on Germany. He presents rather a collection of sketches of individual regions, with dominant emphasis on the explanation of the staff maps. In this way he simplifies the problem and encourages the more comprehensive and systematic study of detailed maps typical of the several regions. This is the aspiration which the author has for his volume, and he succeeds in it very well. The book is not comprehensive in the monographic sense, but neither is it a fragment. It is an improved application of the idea of explanatory description of land forms, to which much attention is being given on the Continent. The author is primarily a morphologist in viewpoint, but he is enlarging this basis along geographic lines. He still feels constrained to say that the problem of the geographer culminates in the description of the land, but his idea of the land is becoming geographic rather than physiographic. For he adds that the individuality of the land may be determined by physical characteristics or it may be a cultural individuality. "Mitteleuropa" is in his mind a physical environment modified by Germanic culture. There is here a clear, if perhaps excessively nationalistic, realization of the interaction of environment and racial stock. The spirit of Ratzel is astir again, and it is bringing a broadened view to the careful scientific worker of morphological training. His actual objective becomes the study of the evolution of *Kulturlandschaft* out of *Naturlandschaft* by resolving the landscape of today into its components, be they natural or cultural. That is certainly a sufficiently clear and sound aim to merit approbation.

The result is a distinct advance in methods of geographic inquiry. The whole treatment is clear and penetrating, pregnant with thought, not burdened with encyclopedic details. The author is at work constructing generalized images of regions as homes of men. Maps accompany the account, and the reader is directed to follow the statements of the text by further map study. There may be a disproportion of space devoted to the formation of the physical landscape, but therein the author simply retains a limitation that the science itself has not outgrown. He has also narrowed his study of geographic responses in the main to the things shown by the map, that is the relation between topography and economy. This particular theme he has worked out

excellently. It would be hard to find more intelligible statements in geographic literature than he presents regarding the location of cities with reference to topography and drainage. There is also a clear recognition of the changing values of the environment with changes in historical conditions.

The general plan is very simple. The first section deals with the form of the natural landscape, the second with the modification of the landscape through its utilization by man, and the third with the present form of landscape (*Landschaftsbild*) for the various regions. One of the most valuable features is the critical bibliography of 53 pages arranged by topics. This bibliography is an impressive annotated record of the large attention and sustained industry that mark the study of regional geography in Germany. The study by Braun may well rank as the most notable contribution to regional geography in current German literature.

C. O. Sauer

Lapland and the Murman Coast

F. H. Butler. **Through Lapland with Skis and Reindeer, with Some Account of Ancient Lapland and the Murman Coast.** xii and 286 pp.; maps, ills., bibliogr. T. Fisher Unwin Ltd., London, 1917. 9 x 6 inches.

The geography and topographic features of Lapland are fairly well known. Carl Vogt, Charles Rabot, and Paul du Chaillu are conspicuous among those who have studied parts of the land. Two-thirds of it was formerly Russian and now is Finnish and Russian. Norway and Sweden divide the other third. The northern section is very mountainous, the rest is largely plain. The author goes there because he knows nothing equal to it for a real health-giving holiday. The air is dry and full of exhilaration; the people are kindly and happy and love their snowy plains even though the sun leaves them for long months. Their wealth is counted in the number of their reindeer, which clothe and largely feed them. In summer, however, the people live mostly on fish, the salmon trout being particularly excellent. Moss is the food of the reindeer, and often they nearly disappear from view in the snow excavations they make to get at their provender.

All Lapps understand one another whether they live in Russian, Finnish, Swedish, or Norwegian territory. Fairs are held in February, when the people exchange their wolf and fox skins, frozen venison, horns, etc., for rice, tobacco, flour, cloth, and other things. Some of the Lapps are rich, and all seem to be comfortable and need no one's commiseration. The author's routes were chiefly in (then) Russian Lapland, and he might, with propriety, have said that there has been reported to be some differentiation between the Lapps of this section and those living in the west.

Cyrus C. Adams

The Physical Geography of West-Central Morocco

P. Russo. **Esquisse du pays Tadla, Maroc occidental.** *La Géographie*, Vol. 32, 1918–1919, No. 8, pp. 570–578. Paris.

The Tadla district in west-central Morocco is of elliptical outline, measuring about 200 kilometers from east to west. It appears to be a moderately depressed basin of synclinal structure, between the Middle Atlas range on the southeast and a series of arid limestone plateaus on the northwest. It is drained to the west-southwest by the Oum-el-Rhia, which, although beset with cascades and rapids farther up and down stream, has an evenly graded course for 125 kilometers or more through the basin plain, in which it is incised to a depth of from 6 to 18 meters; the breadth of the river trench is not stated. The two halves of the basin, each about 25 or 30 kilometers in mid-width, are similarly trenched by lateral streams. On the southeast the basin floor is largely covered with alluvium; here the perennial streams fed from the Middle Atlas range moisten the soil sufficiently to support an agricultural population. On the northwest the plain is more rocky; here the streams disappear in summer, and the population is scanty. The author of this article seems to have attempted an explanatory description of his district, but without full success; first, because the several elements of the landscape are not specifically enough described; second, because the pseudo-learned method is adopted of telling the geological time-scale names of the local rock formations without telling the attitude of their strata; third, because the provincial method is followed of indicating the extent of physiographic features by means of place names that are not found on most maps—for example, the basin plain of Tadla is said to extend "from Bled Imhiouach to Tessaout." The late mention of certain important items is also disadvantageous: the synclinal structure of the district and the entrenchment of the axial river beneath the basin plain are not announced until the last page is reached; they belong on the first page. Altogether, it is difficult to visualize the landscape described.

W. M. Davis

A Vegetation Map of North America

J. W. Harshberger. **[Wall map of the] Vegetation of North America.** Scale, 1:6,170,000. Rand, McNally & Co., Chicago and New York, 1920. $8.00 with wood rod at top and bottom.

The present wall map of the vegetation of North America, prepared by Dr. J. W. Harshberger of the University of Pennsylvania, is suitable for high school and college use and is of interest to all students of plant geography and ecology. The colors and conventions used for the various areas are distinctive, and the mechanical execution of the map is very satisfactory. The author has been successful, in most portions of the map, in mediating between the coarse outlines necessary in a wall map and the accuracy that is necessary in being faithful to the facts. The absence of all political boundaries makes it very difficult, however, to locate specific areas or the lines separating different vegetations.

Twenty-nine types of vegetation are delineated: 8 purely coniferous forest, 4 partially coniferous forest, 4 deciduous forest, 3 sub-tropical and transition types of forest, 2 grassland, 4 desert, and 4 swamp, marsh, and arctic treeless regions. The designations of the various areas are partly in purely botanical terms and partly in terms of the botanical characteristics in conjunction with the geographical location of the areas. In two cases—"Vegetation of San Joaquin and Sacramento Valleys" and "Vegetation and Forests of the Pacific Coast Ranges"—no hint is given as to the character of the vegetations involved. It is not clear what criteria have been used in distinguishing "Tundra and Barren Lands" from "Treeless Regions (above tree limit)." It is doubtful whether the distinguishing features of the "Coniferous Forests of the Northern Rocky Mountains" and the "Coniferous Forests and Vegetation of the Southern Rocky Mountains" are as great as those used in differentiating the other coniferous areas. The distinction involved here is largely a floristic rather than a vegetational one, as is also the case with respect to the characterization of the Edwards Plateau forest of Texas as a "meeting place for plants of Atlantic Coast, Rocky Mountains, and Mexico." The demarcation between the coniferous forests of the southern Rocky Mountains and the sub-temperate hardwood forests of the eastern and western Mexican Cordilleras has been made too far to the north, so far as purely vegetational characteristics are concerned. Much of the area designated as "Deciduous Swamp Forests of the Lower Mississippi Basin" is actually marsh land, occupying a territory of considerable size.

Certain areas of deciduous forests in the highlands of southern Mexico have unfortunately been combined with the very dissimilar vegetations of the eastern and western coasts of Mexico and with the so-called chaparral of southern Texas, and the whole is so designated in the legend as to give the impression that chaparral is synonymous with deciduous forest.

While it is always easy to criticize specific details of a map of this character, it is necessary to bear in mind the very great difficulties involved in its preparation, both with respect to sources of information and the interpretation of very complex plant communities. Viewed as a whole, and with due regard to the difficulties of the task, Professor Harshberger's map is a very creditable piece of work. He has escaped two of the leading pitfalls into which authors of vegetational maps are likely to fall: he has based his areas on purely botanical criteria, without regard to climate, soil, topography, or other causal conditions; and he has used vegetational characteristics in distinguishing his areas, with a minimum of reference to the unrelated floristic features.

Forrest Shreve

Solar Radiation and the Weather

H. H. Clayton. **Variation in Solar Radiation and the Weather.** Introductory note by C. G. Abbot. vi and 53 pp.; maps, diagrs. *Smithsonian Misc. Colls.*, Vol. 71, No. 3. Washington, D. C., 1920.

In the effort to explain the puzzling complexity of changes of climate in the geologic past, variations in the intensity of solar radiation were long ago appealed to as a probable cause. Recently several writers have brought forward a similar explanation in connection with short-period oscillations or fluctuations in various meteorological conditions of the present time. It has, however, remained for Mr. H. H. Clayton, chief of the forecast division of the Argentine Weather Service, to make an intensive study of the relations between solar radiation values and succeeding weather conditions with a view to the improvement and extension of the daily weather forecasts. Mr. Clayton's investigation is therefore distinctly pioneer work, of the greatest practical scientific interest and value. As Dr. C. G. Abbot says in the introduction to the present monograph, the conclusion reached "is of a very revolutionary character and deserves the most careful attention of meteorologists and students of solar physics"

(p. iii), and again, if the conclusions "be true, we stand . . . . on the threshold of a very important research in meteorology" (p. v).

The daily solar measurements made at Calama, Chile, by the Smithsonian Institution, were transmitted to Buenos Aires, at first by mail and then by cable, and were used for forecasting purposes from early December, 1918. By the correlation method, as well as by the method of direct comparison, Mr. Clayton compared all the observations of solar radiation made by the Smithsonian Institution, both at Calama and at Mt. Wilson, with the temperatures and rainfall of Argentina. Further comparisons were also made, in an earlier paper, between the weather in remote parts of the world and the Mt. Wilson observations. It is impossible, in a brief note such as this, to follow Mr. Clayton's very careful and painstaking research in detail. Briefly, his main conclusion is (1) "that if there were no variation in solar radiation the atmospheric motions would establish a stable system with exchanges of air between equator and pole and between ocean and land in which the only variations would be daily and annual changes set in operation by the relative motions of the earth and sun; (2) the existing abnormal changes which we call weather have their origin chiefly, if not entirely, in the variation of solar radiation." During the summer, high values of solar radiation are followed, a few days later, by high temperatures at Buenos Aires, and decreases in solar radiation are followed by rain. In winter, the relation is different, increases of solar intensity being followed three to five days later by rising pressure and cooler weather in Argentina. A detailed study of the lengths of the periods of solar radiation shows that "there is a distinct tendency to form periods around certain lengths," e.g. 3.5 to 3.7 days, 4.9 to 5.3, etc., up to 30 to 34 days. At Buenos Aires the ratio of change of temperature to solar change at the time of maximum solar activity was found, from several years' averages, to be 1.4°C. for each change of 1 per cent of solar radiation. The extreme solar values range about 6 per cent on either side of the mean. Hence departures of about 8.5°C. from the normal at Buenos Aires might result from this cause. Maps are given showing the rainfall on five successive days during which there was a complete daily solar record. On the average, the rainfall follows a solar decrease after about three days in southern Buenos Aires and the Pampa, and after about five days from Corrientes to Tucumán.

The whole investigation is one of the most striking, and is surely one of the most important, which has been brought to the attention of meteorologists in recent years. For about three decades Mr. Clayton has been devoting himself largely to the question of the improvement of daily weather forecasts. With the help of the Smithsonian Institution he has now been able to strike out on a new path, and his conclusions seem destined to revolutionize the whole business of forecasting. Mr. Clayton is not prone to make statements for which he has no good and sufficient scientific basis. Meteorologists, and scientific men generally, may therefore well pay attention to the following: "These studies, it is believed, will permit the prediction of the weather with a fair degree of accuracy for much longer intervals in advance than three days and may perhaps extend them to weeks or years" (p. 52). R. DeC. Ward

A New Standard Manual of Meteorology

Napier Shaw. **Manual of Meteorology. Part IV: The Relation of the Wind to the Distribution of Barometric Pressure.** xvi and 166 pp., maps, diagrs., ills., index. *M[eterol]. O[ffice Publ. No]. 234*, London, 1919. 12s., 6d. 10 x 7 inches.

This fourth part of what doubtless, when complete, will be for a few years the leading reference book on meteorology is a direct outcome of the war. Quite early in the struggle it began to dawn upon those charged with offensive and defensive operations that some knowledge of the structure of the atmosphere was desirable and might even prove helpful. When evidence began to accumulate that the enemy, not only in his offensive air campaign but also in the execution of land and sea operations, had his meteorologists at work and was gaining much thereby, there came hurried calls upon the British Meteorological Office for data about the winds, at the surface, at moderate elevations, and at the great heights. The naval, military, and air services sent in their questions; and one may well imagine that Sir Napier Shaw and his staff had their hands full. It is a fact that, before the war, surface winds only were considered in gunnery and that upper air conditions were unnoticed. This is only one illustration of the sudden awakening which came in 1914 and 1915.

The present volume was issued in advance of Parts I, II, and III because there was much material at the Meteorological Office which had not heretofore been collected and gathered up in available form. Part I, when it appears, will attempt a general survey of the globe based largely on the work of Teisserenc de Bort and Hildebrandsson. Part II will be perhaps the most vital section, dealing with the thermodynamics of moist air; and Part III will formally set forth the dynamics and kinematics which find their application in the problems discussed in Part IV.

The first broad generalization which Sir Napier Shaw employs is that in the free atmosphere the air obeys very closely the laws of motion under balanced forces, the forces depending upon the earth's spin and a small circle spin of the air. In the upper air, rather than at the surface, we find the true relation between pressure and wind. In fact, if the surface wind be taken as the basis of computation, we cannot express in one equation the relation between wind and pressure gradient, representing the underlying principle upon which Buys Ballot's law depends. Taking it, then, as established that the wind at the 500-meter level satisfies the surface pressure-gradients, the first striking development is that in an anticyclone, the curvature of the isobars being great, the winds near the center must be light; which seems to be true in nature; while on the other hand there is practically no limit to the velocity of the wind in small circles, as near the core of a tropical revolving storm or a tornado.

This explains what Shaw has in mind by motion under balanced forces. Air must be regarded as traveling over long tracks of sea and land with very little change of velocity from hour to hour. Even such an incident as being caught in the ascending current of a rainstorm is after all but a small thing in the life history of an air current. The greater part is made up of such steady motion as we see in clouds journeying long distances with little change in speed. The true function of the pressure distribution is to *steer the air* rather than to speed it or stop it. And having once assumed this "strophic" balance to be true, we may call one factor in the equation for gradient wind "geostrophic," due to the earth's spin, and the other "cyclostrophic."

The first six chapters treat of variations of wind with height; eddy motion and Taylor's theory of diffusion of eddy motion based on the analogous diffusion of heat by conduction; turbulence in relation to gustiness and cloud sheets; föhn and chinook winds; variations of vertical velocities, from pilot-balloon observations; and the structure of the upper layers of the atmosphere.

The other five chapters deal more directly with storm movements. In Chapter 9 we are given maps showing the flow of the air at sea level, 305 meters (1,000 feet), 1524 meters (5,000 feet), 3,048 meters (10,000 feet), 4,572 meters (15,000 feet), and 6,096 meters (20,000 feet) at midday October 19, 1917, that being the date when a very strong wind in the upper air carried a fleet of Zeppelins out of their course and once and for all lost to Germany that supremacy in the air which was counted upon to offset the British supremacy on the sea. This was due to the rapid approach of a second "low," with strong southerly winds, in the rear of another "low" passing eastward. What happened was this. On the western side of the first "low" there was a sudden increase of northerly winds above the two-kilometer level. This persistent wind blowing probably 20 meters per second (45 miles per hour) carried the fleet too far south, into the lines of the enemy.

Chapter 10 deals with curved isobars, i.e. revolving polar caps and bands of air flow that maintain themselves for days. One further type, of greatest interest to forecasters, is rotation around a center in circles of relatively small radius; that is, our familiar cyclones. Evidence of stability in motion of this character is found in all circular storms, from the little "dust devils," lasting but a few minutes, through whirlwinds, tornadoes, typhoons, *baguios*, hurricanes, and cyclones, and up to the revolving cap covering a hemisphere.

A fine example is found in the tropical revolving storm charted by the present reviewer (see Fig. 1 in his article on "Wandering Storms" in this issue), which started on a westerly track towards the Philippine Islands (these storms are called by the Manila Observatory *baguios*), then, recurving, crossed the Pacific Ocean and the North American continent, and ultimately was lost south of Iceland. The whole journey lasted from November 20, 1895, to January 22, 1896. This storm, therefore, went halfway around the world.

Finally, Shaw gives us an analysis of the nature of cyclonic depressions, corrections of anemograms for exposure, and some special cases of cyclonic action in the British Isles. Incidentally it appears that the old notion that variations of temperature at the surface are the initial causes of cyclonic circulation must be scrapped. There are too many known cases of convective heavy rains without consequent circulation.

The book is well printed; the illustrations are clear and properly placed. When we recall that most of the work of preparation must have been done during the stress of war, certainly a large measure of commendation must go to Mr. J. B. Peace, Printer to the University of Cambridge, an old friend and colleague of Sir Napier's.

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